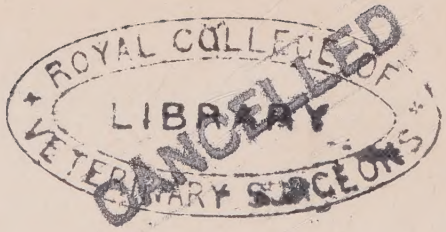
# MEAT INSPECTION PROBLEMS

W. J. LEONARD



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*WITH SPECIAL REFERENCE TO THE DEVELOPMENTS OF RECENT YEARS*

BY

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# PREFACE

THERE are certain difficulties in connection with meat inspection work which justify careful consideration, and the object of this contribution is to pass under review the more notable of these problems.

Chapters II., III., IV., and V. were delivered as the Milroy Lectures before the Royal College of Physicians in 1917, and were published practically in their present form in the *Lancet*. It has been suggested to me that certain additions would be an advantage, and accordingly several appendices have been included as well as an introductory chapter.

In view of the important part which lymphatic glands play in meat inspection, a brief outline of the position of these glands has been prepared, as well as two diagrams which will help to facilitate the appreciation of the respective drainage areas. The description follows Buckley and Castor's monograph, which contains the best connected description of the lymphatic glands with which I am acquainted, and to which work I express my indebtedness.

Certain illustrative examples of suitable regulations bearing upon meat inspection are submitted. These have been taken from the Regulations in force in the United States; but in considering American Regulations as a whole, it should always be remembered that there exists in that country special provision for the sterilisation of certain classes of unsound meat. This provision necessitates a variation of decision in the two countries, when conditions are under consideration for which sterilisation is an approved process.

Decisions, in cases of tuberculous infection, are the constant duty of meat inspectors in this country, and in this connection an attempt has been made to furnish a reasoned argument in support of such action as is advised. Decisions which are not based on accepted principles are certain to result both in considerable waste and in absence of uniformity. This has been the chief cause of contention between traders and inspectors in the past, and in my opinion the time has now arrived when the suggestions of the Royal Commission relating to the disposal of tuberculous carcasses might well be replaced by a more complete set of regulations.

As regards the sale of unsound meat, a report presented to the City Corporation in the early part of 1917 has been included, and although this report deals with the subject as it affects the City of London—in which area certain administrative difficulties are present—the main arguments for and against the proposal are set out.

I desire to express my thanks to Doctors Eastwood and Griffith for permission to use the material contained in their excellent report on Localised Tuberculosis in Swine; to Professor Wooldridge for useful criticisms bearing upon Cattle Tuberculosis; to Mr. O. Sharp, Senior Inspector of Meat at Smithfield, for collecting special examples of disease in cattle; and to Mr. Hayhurst, Superintendent of the Islington Cattle Market, for similar assistance in the case of pig tuberculosis.

I am indebted to the Corporation of the City of London for their permission to prepare and deliver the lectures.

WILLIAM J. HOWARTH.

GUILDHALL, E.C. 2,
*January*, 1918.

# CONTENTS

## CHAPTER I

### THE DEVELOPMENT OF MEAT INSPECTION



## CHAPTER II

### GENERAL ADMINISTRATIVE PROBLEMS



## CHAPTER III

### THE TUBERCULOSIS PROBLEM AS AFFECTING CATTLE

## CHAPTER IV

### THE TUBERCULOSIS PROBLEM AS AFFECTING PIGS



## CHAPTER V

### IMPORTED MEAT



## APPENDICES

# MEAT INSPECTION PROBLEMS

## CHAPTER I

## THE DEVELOPMENT OF MEAT INSPECTION

England as a meat consuming nation—Early legislation to protect consumers—Control by Guilds—Legislation from 1847—Development of the present unsound meat clauses—Giebler *v.* Manning—Hewitt *v.* Hattersley—Reports of Special Committees on various aspects of the meat trade—Reports of Royal Commissions—Administrative progress.

A BRIEF account of past action which has been taken by the legislature, together with some reference to the various reports which have been issued on matters affecting the different problems as they have arisen, may be of service by way of introduction, since by this means a clearer appreciation of the difficulties and imperfections of meat inspection, as it is at present carried out, will be possible.

The inhabitants of this country have probably always subsisted on a mixed dietary of flesh meat and vegetable products, such a combination being physiologically necessary to maintain physical vigour in temperate zones. During Saxon, and even Norman times, meat and fish were more commonly consumed in the salt than in the fresh form. In the latter period it is stated that cooked meat and game in season could be purchased in London shops. Excessive prodigality in feasting, which was increased rather than diminished by the Danish invasion, was a feature of Saxon hospitality, and had it not been for this trait, the history of England from the Norman invasion might have been

a different story. Similarly, in the thirteenth and fourteenth centuries, royal feasting was carried out on an excessive scale, and the hospitality displayed by the barons and gentry necessitated large stores of food being kept in the castles. The extent of a baronial larder may be gauged by the amount recorded as having been stolen from one establishment in the reign of Edward II.: it included 80 carcasses of beef, 600 carcasses of mutton, and 601 flitches of bacon.[1]

In the fifteenth and sixteenth centuries, with the decline of feudalism, much of this generosity died out; but feasting on special occasions was still continued on a luxurious scale; and though the substantial character of the viands began to be replaced by more elegant dishes, the baron of beef at city feasts always retained a place of honour.

Meat was plentiful in Elizabethan times, and Stowe, writing in 1598, says, "The cooks cried hot ribs of beef roasted, pies well baked, and other victuals." The roast pig of the Bartholomew Fair days was renowned both in the City and the surrounding country, and it is described of Pye Corner,[2] that "piggies are al houres of the day on the stalls, piping hot, and would crie (could they speak) 'come eat me, eat me.'" The loin of beef was knighted Sir Loin some say by Henry VIII., and others by Charles II., at Friday Hall, Chingford, the occasion being after a day's hunting in Epping Forest, when the tempting joint so pleased the hungry king that he conferred on it this mark of royal favour.

And so one might proceed, but it is sufficient to recognise that the English have always been a meat-eating nation, and that the supply of animals to satisfy the wants of the inhabitants must have included many which were diseased and unfit for human consumption, with the consequence that the necessity for adopting preventive measures would sooner or later arrive.

It has probably always been an offence against the

[1] "Good Cheer," by Frederick W. Hackwood.
[2] Corner of Giltspur Street, City.

Common Law for a butcher to sell meat for human consumption which he knows is not fit for that purpose, and the liability to be indicted for an offence in the case of resulting injury must have stimulated butchers, even if inadequately, to exercise some sort of supervision over the character and quality of meat which they exposed for sale. Whatever may have been the value of such a stimulus it was always retrospective in effect. Many facts require to be proved before a charge of this nature can be sustained; they are therefore inferior to many of the present day statutes in which offences are definitely stated which, as a consequence, makes them anticipatory in effect. Although Statute Law dealing with the subject is mainly a modern development, there were certain ancient statutes which had direct reference to unsound food, and in the interval between the passing of the ancient and the modern enactments, the traders themselves exercised supervisory powers by means of their trade guilds.

The Statute of the Pillory and Tumbrell of 51 Henry III. c. 6 (1266–1267) required that inquiry be made "if any butcher do sell contagious flesh, or that hath died of the murrain (or if any do buy flesh of Jews, and then sell it to Christians). Also of cooks that seethe Flesh or Fish with bread or water or any otherwise, that is not wholesome for Man's Body, or after that they have kept it so long that it loseth its natural wholesomeness, and then seethe it again, and sell it."

Similar provision prohibiting the purchase of flesh from Jews and the sale of "flesh dead of the Murrain" is contained in the *Statutum de Pistoribus et Braciatoribus et aliis Vitellariis* of Edward I. (1302–3) or Edward II., the date being uncertain, but with the addition that the sale of "Swine's Flesh meazled" was prohibited. Both these statutes were repealed by the Act of 6 & 8 Vict. c. 24.

The Craft Guilds at a very early date assumed responsibility for the inspection and examination of meat. They also controlled apprentices, provided for mutual

protection, and regulated the markets. On the Continent, and perhaps to a less degree in this country, the Guilds took an active share in the defence of their town, a notable instance being the help of the Butchers of Liege at Steppes in 1213.[1]

The Worshipful Company of Butchers [2] existed as early as 1180, but at that time without due legal recognition. They, with seventeen other companies, were fined in that year as being an "adulterine guild."

In 1319, 13 Edward II., Nov. 12, "the sworn wardens of flesh meat in London," who belonged to the Butchers Company, "brought to the Shambles called 'Les Stokkes,' seized, two beef carcasses, putrid and poisonous, taken from William Sperlyng, of West Hamme, he intending to sell the same at the said Shambles. The said Sperlyng being taken before the Mayor and Aldermen, acknowledged he intended to sell the beef, but insisted that it was good, clean and fit for human food, and demanded inquisition thereon. And a jury of twelve say on oath that the said carcasses are putrid and poisonous and have died of disease."

"The Mayor and Aldermen order the said Sperlyng to be put in the pillory and the said carcasses to be burnt beneath him."

The above extract is interesting from the fact that it gives an ancient precedent for the butchers' jury which even to-day is recognised in some districts.

In 1320, Edward II., July 25, a similar punishment was imposed upon William à Clerk, of Higham Ferrers, for a like offence.

On May 7th, 1 Henry VI. (A.D. 1423) the ordinances of the Mistery of Butchers,[3] which were approved by the

[1] "Guilds: Their Origin, Constitution, Objects and Later History," by Cornelius Walford, F.I.A., F.S.S., F.R.H.S.

[2] "A Sketch of the Early History of the Worshipful Company of Butchers of London," by Joseph Dale, Clerk to the Company.

[3] "Calendar of Letter Books preserved among the Archives of the Corporation of the City of London." Edited by Reginald R. Sharpe, D.C.L. Letter Book (K).

Mayor and Corporation, included one which made it an offence for a butcher to sell fragments of meat on Saturday that might have been kept over from the previous Thursday.

On October 12th, 2 Richard III. (A.D. 1484) came good men of the "Mistery of Butchers" to petition the Lord Mayor among other things, "That the Wardens (of the Butchers Craft) be authorised to search for 'all manner boores and hogges brought hider here to be sold or occupied, and all such boores and hogge as thei finde mesels or otherwise unwholsom for mannys body frely to seaze theym and forfeit theym and dampne theym to be cast awey.'"

Various interesting rules were made by the guilds in other towns of which the following are worthy of notice.

Oxford.[1] The charter of this Company is recorded in the archives of that city under date 1536. It is recorded that "ye M^r^ and Wardens of the bochers shall have the serch of all fleshe that shal be slayne or killed w^th^in ye Towne and suburbs of Oxford or franchises thereof, to be sold in grosse or by retayle, and if they finde any fleshe not wholesome, then to seaze uppon it as foresayted, and the party offending to be punished by y^e^ Mayor and y^e^ Justices for the time beinge, and y^t^ any bocher bringinge fleshe to the Towne to be sold, shall also bringe the hide or skin and tallow of the same flesh to be sold there, under payne of forfeyture."

The Newcastle-upon-Tyne butchers by an Ordinance of the local Guild, which has existed since the year 1621, decided that no free brother should blow a calf's pluck, or any part of a calf, except calf's close-ear,[2] nor any other goods but a cow's udder, under a penalty of 6*s.* 8*d.* unforgiven. It is interesting to observe that the blowing of veal was regulated so long ago.

[1] "Gilds," Walford.

[2] Calf's close ear=the right kidney. *Close* is the right side of a carcass and is so called because the kidney on that side adheres more closely than on the left, which is called the open side. *Ear* (used in Northumberland, Cumberland, Durham and Suffolk) means kidney. *Near* also means kidney, therefore the near end of a joint is the kidney end. (The English Dialect Dictionary, 1898, by Joseph Wright, M.D., Ph.D., D.C.L.)

The Carlisle Guild [1] dates back to about 1665, and in 1697 they decided that "for the future noe butcher of this fraternity shall lessin or say that any of the brotherhood sells or hath sold rotten or bad meat which may tend to the prejudice of any of this brotherhood upon paine iii iii but such things shall be left to the clerk of the market and the clerke of our fraternity."

Pontefract. There was a company of dealers in flesh meat in this town in 1652, and one of their rules required that no corrupt flesh should be sold without the full consent of the purchaser.

It is extremely improbable that anything more than a perfunctory supervision was exercised until very recent times, for so recently as 1862 Sir John Simon in his Fifth Report to the Privy Council stated that a very large proportion, possibly as much as a fifth part of the common meat of this country, beef, veal, mutton, lamb, and pork, came from animals which were considerably diseased, and that there was no effective obstacle for putting such meat on the market.

Modern legislation may be considered from the year 1835, when the Municipal Corporations Act made it lawful for the council of any borough to make bye-laws for the good rule and government of the borough. In numerous instances advantage was taken of this power.

The official designation of meat inspectors varied, examples being a "body of Headboroughs" at King's Lynn; "Fish and Flesh Testers" in Newbury; an "Inspector of Provisions" in Cambridge; "Flesh Conners" in Tamworth; "Searcher of Flesh" in Derby; and "Carniters" at Wareham.

Local powers began to be sought by various municipalities to enable them to supervise the meat trade, and in Liverpool by virtue of an Act, 5 & 6 Vict. c. 106, the jury system was made legal. An Inspector, if he found any apparently unsound or unwholesome food, was empowered

[1] "Municipal Records, City of Carlisle," by R. S. Ferguson, M.A., F.S.A., and W. Manson, B.A., F.S.A.

to call in a jury of not less than three respectable butchers, whose verdict was taken as to the validity of the seizure. The jury were paid 6*d.* each for their trouble. Somewhat similar action was taken in Bradford, and in Leeds the corporation selected twelve of the most respectable butchers in the town to form a panel from among whom three could be selected by the Inspector to assist him in doubtful or difficult cases.

The Towns Improvement Clauses Act was passed in 1847, and sec. 131 is still operative, notwithstanding its similarity in terms to the corresponding provisions in the 1875 Public Health Act. The food actually within the scope of this section is butcher's meat only.

In the same year the Market and Fairs Clauses Act, which also is still operative, made it an offence for any person to sell unwholesome meat or provisions in the Market or Fair. It will be noticed that there is an extension of articles coming under supervision, although there is a restriction of the area of jurisdiction.

In 1848[1] the supervised articles were increased by including "animal, carcass, meat, poultry, game, flesh, or fish," and the places where such supervision was authorised to "any shop, building, stall, or place kept or used for the sale of butcher's meat, poultry, or fish," and also any slaughter-house. This Act was repealed by the Public Health Act, 1875.

In 1855,[2] the list of articles liable to seizure was again extended by the addition of "fruit, vegetables, corn, bread, or flour," and the conditions rendering them liable to seizure, to "exposed for sale, or in the course of, or on their way to slaughtering, dressing, or preparation for sale or use, or landed from any ship, or vessel in any port in England."

In 1863,[3] the requirements "exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale

[1] Public Health Act, 1848, sec. 3.
[2] The Nuisances Removal Act, 1855, sec. 26.
[3] The Nuisances Removal (Extension) Act, 1863.

and intended for the food of man, the proof that the same was not exposed or deposited for such purpose or purposes or was not intended for the food of man resting with the party charged," and the terms "diseased, unsound, unwholesome and unfit for the food of man" were used and these form the basis of the unsound food clauses in the Acts now operative.

In 1874 [1] power was given to justices to grant a search warrant, if there was reason to believe that any of the specified articles were on the premises and were not fit for human consumption. Milk was also included as an article liable to seizure.

The Public Health Act of 1875, consolidated the provisions contained in the above enactments, and at the present time it stands as the principal Act which regulates the sale of unsound food in the provinces. The articles liable to seizure are those enumerated in the Acts of 1848, 1858, and 1874, and the conditions under which seizure may be effected are similar to those of the 1863 Act. Various improvements in procedure are also provided for.

In the year 1875, the Food and Drugs Act was passed; and although it was not contemplated that inherent defects due to disease, or putrefactive changes in meat rendering it unfit for human consumption, should be dealt with under this Act, it certainly enables "prepared foods" to be regulated from the point of view of the addition of objectionable preservatives or colouring matter.

The Merchandise Marks Act, 1887 and 1891, provides some security, if that be necessary, against the substitution of imported meat for home-killed. The trade in this article had been rapidly increasing before these years and a Select Committee of the House of Lords sitting in 1893 advised that the Board of Agriculture should be possessed of similar powers to those conferred on the Board of Trade by the 1891 Act, so as to enable that Board to take proceedings in cases of substitution. The Act of 1887 made it an offence

[1] The Sanitary Laws Amendment Act, 1874.

to apply a false trade description to any " goods " ; " goods " meaning anything which is the subject of merchandise, and " trade description " including any description, statement, or indication, direct or indirect, as to the place or country of origin in which the goods were made or produced.

The Public Health Acts (Amendment) Act of 1890 is an adoptive Act which by section 28 extended the articles liable to seizure under the 1875 Act to *all* articles intended for the food of man, and enlarged the conditions so as to include meat which had actually been sold, and as a consequence might have passed out of the seller's possession.

In 1891 the Public Health (London) Act was passed, and this included provision for dealing with unsound meat, practically on the same lines as in the provinces under the 1875 Act and the Amending Act of 1890, but it altered the phrasing of the section which provides for condemnation by a magistrate. It also increased the powers of inspectors and the range of penalties.

Various decisions affecting the interpretation of different sections have been made since the above Acts became law, but reference will only be made to two affecting the 1891 Act, Giebler *v.* Manning,[1] and Hewitt *v.* Hattersley.[2]

As regards Giebler *v.* Manning. If sections 116 and 117 of the 1875 Act are compared with section 47 of the London Act, a difference in wording will be noted. In both, a medical officer of health or sanitary inspector may inspect and examine food intended for human consumption, and if any is found under certain specified conditions to be unfit for the food of man, either of these officers may seize it and carry it away to be dealt with by a justice. In the former Act, however, the justice has power to deal with articles *so seized*, but in the latter Act the justice may deal with any article " which has been seized or is liable to be seized under this section." These latter words are of a general character and not restricted as they would have been had the section

[1] Giebler *v.* Manning, 75 L. J. K. B., p. 463.
[2] Hewitt *v.* Hattersley, Times Report, May 15th, 1912.

read "if it appears to a justice *on the information of such Medical Officer or Sanitary Inspector* that any . . . article which has been seized or is liable to be seized." The effect of this is that summary proceedings for a fine under section 47, sub-section 2, of the Public Health (London) Act, 1891, against a person to whom unsound meat belonged which has been condemned, may be taken by a private individual, and therefore an inspector in London may seize meat in his private capacity and take proceedings in the court without any instructions from his authority. There is the restraining influence, however, that he, and not his council, would have to accept liability in case of failure for the costs of the proceedings; and he would also have to defend himself against an action for malicious proceedings if subsequently raised.

If this is a correct interpretation it is unfortunate, since it is difficult to understand why other than the local authority or a person aggrieved should be in a position to undertake this responsible work without exceptional reason. This view is apparently that intended by the 1875 Act, since by section 253 proceedings for the recovery of any penalty under the Act, except as expressly provided, cannot "be had or taken other than by a party aggrieved or by the Local Authority of the district in which the offence is committed without the consent in writing of the Attorney-General."

The case of Hewitt *v.* Hattersley is also of interest. The Fishmongers Company, by virtue of their ancient charter, seized certain fish in the City of London and subsequently took proceedings for a penalty under section 47 of the London Act *without* a justice having been called in to condemn the seized articles. The defendant was convicted, and on appeal it was decided by Lord Chief Justice Alverstone and Justice Avory, Justice Pickford dissenting, that *condemnation was not* a necessary preliminary to proceedings under this section. Notwithstanding this decision it does not seem probable that a sanitary authority would care to instruct one of their

officers who had seized meat, to take proceedings unless the articles had been first condemned by a justice. It is certainly difficult to appreciate fully the object of magisterial condemnation, since the justice rarely possesses the knowledge necessary to decide whether the article is or is not fit for human consumption. The fact of having to submit a seized article to an independent person may act as a check on excessive zeal or the condemnation would appear to some extent to be an action which confirms the opinion of the inspector, though it is doubtful whether that would have any great weight with the bench hearing the case. Notwithstanding the difficulties which one experiences in deciding the real object of magisterial condemnation, it would appear to be a sound assumption that such a requirement can only have been inserted in an Act of Parliament with the intention that the course of action outlined should be followed by officers of a sanitary authority. If that is so, it is not reasonable to assume that others should have power to proceed on less onerous lines. Another point associated with the same subject may be mentioned. There was no fine inflicted in the last-mentioned case ; if there had been, would it have been necessary to pay the fine to the City Corporation ? The particular section in view in connection with this observation is 119 (1) of the Public Health (London) Act, 1891, which reads as follows :—

" 119.—(1) All fines recovered under this Act shall, notwithstanding anything in any other Act, be paid to the Sanitary Authority, and applied by them in aid of their expenses in the execution of this Act. . . ."

The present powers regulating meat inspection in Scotland were obtained in 1897 by the passing of the Public Health (Scotland) Act. These differ materially from those in force in England and Wales. A veterinary surgeon is included with the Medical Officer of Health and Sanitary Inspector as an officer authorised to enter premises to inspect food, and in addition, these officers may search any cart, vehicle, barrow, basket, sack, bag or parcel in order to inspect or

examine, and he may inspect or examine any animal, living or dead, or any article whether solid or liquid intended for the food of man. Power is given to examine food whilst "in course of transmission," an authority not specifically conferred by the English Acts. There is the interesting provision which enables local authorities to combine for the purpose of arranging for a veterinary surgeon to conduct meat inspections and for him to give a certificate which, if issued in prescribed form and manner, exculpates the owner from a charge of exposing unsound food. It is necessary at these inspections that the whole carcass shall be available for inspection together with the thoracic and abdominal viscera. This is a considerable advance in State recognition of the requirements which are essential fundamentals if an opinion of real value is to be obtained.

The Sale of Horseflesh, etc. (Regulation) Act of 1899, forbids the sale for human consumption of the flesh of horses, asses, or mules, except under circumstances which make it clear that on the particular premises horseflesh is sold. It tends to prevent the substitution of such meat for that of bovine flesh.

The Public Health (Regulation as to Food) Act of 1907 empowers the Local Government Board to make regulations for the prevention of danger to the public health arising from the importation, preparation, storage, and distribution of articles of food or drink (other than drugs or water) intended for human consumption. Regulations relating to foreign meat and imported food have been made, and these now constitute the basis of the inspection of imported meat and food. They will be referred to later.

The placing of these different enactments on the Statute Book was preceded in many instances by consideration of the subject by various parliamentary committees, which in their turn had been appointed in consequence of pressure of public or interested opinion. It is unnecessary to refer to all in detail, but certain reports of the last twenty-five years are of interest.

In August, 1893, a Select Committee of the House of Lords reported on the "Marking of Foreign and Colonial Produce." At this time it was asserted of animals imported from abroad and slaughtered at Deptford, that the meat was often labelled "Prime English." The English agriculturalists objected, as it affected the sale of home stock, and substitution was encouraged owing to the difference in price between American beef, in which a most important trade was then being conducted, and English—and Scotch—killed butcher's meat. There was a still greater difference between the price of frozen mutton and fresh mutton. Twenty English County Councils and certain other authorities in England and Wales had petitioned the Board of Agriculture in favour of marking imported meat.

The Committee reported that dealers in imported meat should be registered as such, and display a notice to that effect.

A Select Committee reported in July, 1897, on the Agricultural Produce (Marks) Bill to the effect that the identification of foreign meat and cheese was desirable, and that no great difficulty would be experienced in carrying this out in the case of foreign carcasses and cheese. They intimated that it would be necessary to distinguish between British or Irish meat on the one hand, and (1) that produced in our colonies, and (2) that produced in all other countries and landed here to be slaughtered at the port of debarkation, on the other.

These proposals again obviously aimed at preventing substitution, but witnesses were not wanting who asserted that imported meat was as good, if not better than home-killed, and although imported might be substituted for home-killed meat, the imported meat trade suffered since some butchers sold the poorest quality of home-killed as imported.

Although no direct legislation on the lines recommended followed, the attention of importing countries was directed to the feeling which existed in this country. The

confidence of colonial and foreign traders in the value of their own produce and the commercial importance of the subject, aided by commencing changes, the effects of which were not then fully recognised, has brought about, without a special Act, almost the very arrangement desired. The trade in imported live stock for slaughter has almost entirely ceased, as also has the importation of carcass meat from America, and the trade with other countries has passed into the hands of large firms who have an enormous amount of capital at stake, and who recognise the necessity for maintaining a high standard. The result is that the traders themselves in the chief exporting countries each mark their meat with a trade mark readily distinguishable, and have brought pressure to bear on their respective Governments to inaugurate, and develop, a system of meat inspection and marking, to which all carcasses for export are now subjected.

In 1898 the Committee, which had been appointed in 1896 to inquire into the administrative procedures for controlling danger to man through the use of meat and milk of tuberculous animals, issued their report. This date is important in meat-inspection work, for with the passing of the 1875 Act public health measures had received a considerable impetus ; new officers who had been specially trained in sanitary work were being appointed everywhere, and as many problems were awaiting solution, or obvious defects demanding remedy, the years following were characterised by great activity. Among the subjects which received much consideration, was that of the control of tuberculosis. It was known that much tuberculous meat was being sold to the public, and although some held what may perhaps to-day be considered an exaggerated view of the dangers which follow the consumption of tuberculous flesh, others regarded the matter more complacently, even suggesting if there was so great a danger as suggested, the race ought long ago to have been exterminated as a consequence of past neglect. There resulted the greatest lack of uniformity. A universal desire was made evident for an

official pronouncement on the subject, and as a consequence this Commission was appointed. The decisions at which it arrived are those which in the main regulate meat inspection of to-day.

The Commission recommended that full powers be granted to urban authorities to require that all cattle should be slaughtered in a public abattoir, and that the meat of animals slaughtered outside the district should be brought to a central place to be inspected before being sold in the district. They recommended that meat inspection in rural districts should devolve upon County Councils, and that in rural areas no meat should lawfully be exposed for sale unless the animal had been slaughtered in a duly licensed slaughter-house. A minimum course of instruction for meat inspectors was advocated; and finally it was recommended that the Local Government Board be empowered to issue instructions for the guidance of meat inspectors, prescribing the degree of tubercular disease which, in the opinion of the Board, should cause a carcass or part thereof to be seized. A schedule containing fairly definite recommendations in this connection was issued, and in 1899, the Local Government Board, by circular letter, advised local authorities that the points mentioned by the Royal Commission as regards the practice to be followed in the case of dealing with tuberculous meat, should be observed. The Board also intimated that there was no power to require a person to pass a qualifying examination of the kind referred to by the Commission before he acts as a meat inspector, yet it was thought that regard should be had to this requirement before making further appointments of inspectors of nuisances if meat inspection were to be included in the duties.

In 1904 the Local Government Board issued a circular letter to local authorities setting out the desirability of obtaining uniformity in meat inspection, and referred to the view expressed by the Select Committee of that year, relating to the notification of the authority by a butcher

that he was in possession of unsound meat. The Board expressed approval of the suggestion that such a case should not be taken into court so long as the notification was made as soon as the butcher could be reasonably expected to be aware of the fact.

In 1904 the Admiralty Committee reported on the humane slaughtering of animals, and in this report the Jewish method of slaughter was subjected to criticism. It was recommended "that, until some method is devised, and adopted, for rendering the animals unconscious, previous to the 'casting' and throat-cutting operations, the Jewish system of slaughtering cattle should not be permitted in any establishment under Government control." Certain of the proposed regulations were incorporated in the series of model byelaws, issued in 1909 by the Local Government Board, for the supervision and control of slaughter-houses.

In 1900, Professor Koch introduced a disturbing element by his pronouncement in London that there was a difference between the tuberculosis of human beings and animals, and called in question the correctness of the opinion that tuberculosis can be transmitted from animals to man. As a consequence the Local Government Board, in 1901, issued a circular letter, and suggested that, pending the report of a Royal Commission which it was proposed should investigate the subject, local authorities should not relax their present methods, and the Board again directed attention to the principles laid down by the Commission of 1898. This new Commission was appointed in 1901.

An interim report was issued in 1904, in which is contained the conclusion that the bacilli found in the lesions of certain cases of human tuberculosis produced in cattle a disease indistinguishable from bovine tuberculosis.

A second interim report was issued in 1907, which dealt with the results then obtained of an investigation of the characters of the bacilli found in cases of bovine and human tuberculosis.

A third interim report, dated 1909, dealt with tuberculous conditions in the cow which rendered the milk infective.

The final report, issued in 1911, contains an account of the investigations continued, in the case of the ox and man, from the point at which they were left in the second report, and also deals with the conditions observed in pigs, horses, some other mammals, and birds.

In reporting to the terms of their reference, the Commission regarded the human and bovine types as varieties of the same bacillus, and the report continues, " there can be no question that human tuberculosis is in part identical with bovine tuberculosis " ; but as regards the question whether avian tuberculosis is the same disease as either human or bovine tuberculosis, the committee state " there does not appear to us to be in the present sufficient ground for answering the question in the affirmative." This is a somewhat important decision affecting the work of meat inspection, since the avian type is by no means uncommon in cases of swine tuberculosis.

In answer to the second term of the reference, the Commission considered that animals and man can be reciprocally infected with tuberculosis, and as regards the third reference, they reported that the avian tuberculosis bacillus was never found by the investigators in human lesions ; the monkey was found to be extremely resistant, whilst the pig was the only mammal in which the avian bacillus was found in the lesions of naturally acquired tuberculosis. The report continues, " but possible danger to man from this source would appear to depend on an ability not yet demonstrated of this animal to bring about modification or alteration of this type of tubercle bacillus in the direction of greatly enhancing its value for man. We must conclude, as the result of our investigation, that the unmodified avian tubercle bacillus is a negligible factor in the production of human tuberculosis." Human tuberculosis is spread chiefly by man to man, and although this type of bacillus is capable of causing infection among lower animals than man, there

are very few in which it is liable to cause severe generalised tuberculosis, and none of these active multipliers are common food animals. The final decision is not a firm one, and is to the effect that " it is not to be affirmed with confidence that man is wholly free from risk, through animal food, of infection with that type of tubercle bacillus to which he appears most prone." The pig is regarded as a possible source of danger in this connection, since particular glands of the pig's body, which are likely to enter into certain prepared foods do, on occasion, yield tubercle bacilli of the human type.

The Commission continued to the effect that the pig, besides the bovine, is the only animal commonly used for food by man in which the bovine bacillus was found to produce the progressive lesions of the natural disease. " Bovine tubercle bacilli are infective to human beings, and we have no reason to suppose that they can be rendered less so by previous residence in the bodies of pigs."

The facts ascertained caused the Commission to report as follows : " We would urge that existing regulations and supervision of milk production and *meat preparation* be not relaxed ; that, on the contrary, the Government should cause to be enforced throughout the Kingdom food regulations planned to afford better security against the infection of human beings through the medium of articles of diet derived from tuberculous animals."

In addition to these various reports much valuable work has been done by independent investigators, and only a few of these need be mentioned.

Many reports of diverse nature have been made which have helped forward the scientific aspect of meat inspection, such as that of Dr. J. L. W. Thudicum,[1] in 1865, on the Parasitic Infections of Food Animals, and Dr. Ballard's report, in 1890, on Food Poisoning Outbreaks. This latter

[1] Seventh report of the Medical Officer of the Privy Council referring to the year 1864. Report by Dr. J. L. W. Thudicum on the Principal Parasitic Diseases of the Quadrupeds which are used for Food.

dealt mainly with the epidemiological aspect of the subject, and has more recently been brought up to date by Dr. Savage. Considerable work on the same subject was done by Klein and Durham, and reference must also be made to Professor Delèpine, who has carried out much research work in the matter of tuberculosis and food poisoning, and to Sir John McFadyean, whose investigations have gone far to place the question of condemnation of tuberculous meat on a sound basis.

The Local Government Board, it must be acknowledged, has also undertaken new obligations, and carried them out in a way which has proved most helpful to local authorities, and their executive officers. In 1905 the Board created a special division of the medical department for duty in relation to food problems. Dr. Buchanan was placed in charge, and he has since been succeeded by Dr. MacFadden. This department has issued a large number of valuable reports relating to food problems, which have included such subjects as pig tuberculosis, both as regards administrative measures and pathological investigations ; imported meat, in the form of bacon and pork from China and Siberia ; the flesh of bovines from Australia affected with onchocerciasis ; the nature of the actinomycotic lesions observed in Argentine ox tongues, and many others, including an annual report which sets out contemporary problems of interest to meat inspectors.

The Board, recognising the importance of outbreaks of food poisoning, issued instructions, in 1911, to the various local authorities as to the methods which should be adopted in investigating and dealing with these outbreaks ; and also arranged for the bacteriological examination of suspected products.

Returns made to Parliament give some indication of the progress which has been made in recent years by local authorities in appointing suitable officers to carry out meat inspection work. For example, in 1863, inquiries made of the town clerks of 169 towns in England and Wales, showed

that during the years 1861 and 1862 no meat had been condemned in 93 of these towns. In the others, the amount varied from 12 lbs. in Kingston-on-Thames to 9½ tons in Birmingham, and 97 quarters of beef with other condemned articles in the City of London.

In 1896 a return as to the number of officials employed on meat inspection in many of the large towns in England and Scotland, as well as in the metropolitan area, indicated that, particularly in London, men were engaged on the work whose previous training was not such as fitted them for the responsibilities of meat inspection; these included plumbers, carpenters, builders, and policemen.

The return of 1904 from English towns and the Metropolitan boroughs indicated that considerable improvement was taking place. Meat inspectors were more generally employed, and they were more frequently selected from among butchers, and trained sanitary inspectors, the greater proportion of whom had prepared themselves for the work by obtaining the certificate for proficiency of knowledge in meat inspection granted by the Royal Sanitary Institute.

The hygiene of slaughter-houses is one which is closely associated with meat inspection, and certain improvements have been effected as far as relates to the nuisance aspect of the problem, but the general principle of the provision of public abattoirs to replace private places is still the subject of controversy.

In 1840 the Commission appointed to inquire into the state of large towns and populous districts reported on the impairment of health which resulted from the unhygienic condition of slaughter-houses as they then existed; and Dr. Simon in 1847, in his first Annual Report to the City of London, stated that there were 138 registered slaughter-houses in the City in 58 of which the slaughtering took place in cellars. Since these times the various Acts have rendered additional supervision possible and have increased the powers to enforce improvement.

As regards administrative instructions, the Local Government Board have issued at different times (1891 and 1910) to the local authorities in both London and the Provinces, General Orders, in which, *inter alia,* are set out the duties of both Medical Officers of Health and Sanitary Inspectors. The supervision of the food supply is included in each group, and the Medical Officer of Health is now required by the General Order of 1910 (Article XIX., 14, c.) to insert in his Annual Report a paragraph containing "a statement as to the conditions affecting the wholesomeness of foods for human consumption other than milk, produced or sold in the district."

## CHAPTER II

## GENERAL ADMINISTRATIVE PROBLEMS

Scope of Milroy Lectures—Lack of uniformity in meat inspection —Statistics relating to condemned carcasses and organs in well-inspected districts—Comparison with same in ill-inspected areas—Deficient facilities for inspection—The "marking" of inspected meat—Necessity for regulations to control inspections and scope of same.

THE subject of Meat Inspection will, I believe, receive more attention after the war than has been the case in previous years. Many striking anomalies, and defects of an administrative character which call for reform and improvement exist, and to these, official notice was being directed before the great upheaval temporarily relegated them along with other reforms to a position of comparative obscurity.

The distinguished physician with whose name the Milroy Lectures are associated, and owing to whose munificence they were established, enumerated in a peculiarly happy manner certain principles of necessary sanitary reforms which have proved to be almost prophetic, since they outlined the directions along which practically all later sanitary improvements have progressed. Sufficient time has elapsed not only for these principles to have been put into practice, but for definite results to have been realised, and nobody can deny that they have conferred measureless benefits on the community at large. It must also be a source of satisfaction to English sanitarians to know that their earlier lines of action were so fully appreciated by workers in the same field in other countries that they followed the lead thus given with equally gratifying results.

It is possible that least interest has been displayed in matters associated with the control of the food of the people, and one may safely say that it is only within the last ten or fifteen years that this subject has received the serious attention which it merits. This is somewhat surprising, and although the lead in sanitary reform must rightly be given to Great Britain, progress in matters associated with the food supply has been much more rapid in other countries.

I propose only to deal with that part of the subject which concerns the inspection of flesh meat, and it will be my endeavour to emphasise the fact that a system of meat inspection cannot be regarded as satisfactory until greater uniformity is secured, and that the actual details of inspection cannot be efficiently observed unless adequate facilities exist. But given the existence of suitable arrangements under these two headings, the fact that a carcass has been submitted to inspection should be noted on the carcass, otherwise much work will be duplicated and wasted energy be the chief result of reform. It follows further, that if an inspector is to accept responsibility for his decisions he should be guided by official regulations, otherwise the personal element will step in, and the opinion of one man will be played off against that of another, as is the case to-day, with the result that many experience unnecessary hesitation in arriving at a decision, and much confusion exists. The chief disease affecting cattle in this country is tuberculosis, and as differences of opinion exist as to the action which should be taken, this subject will be fully discussed. Imported carcass meat and offal now form a considerable part of the general meat supply, and therefore the chief features associated with this trade will be considered. As an associated development the question of the regulation of cold stores will be referred to, and finally the desirability of reform in the handling of meat will be emphasised.

## Lack of Uniformity in Meat Inspection

Meat inspection in this country, with the exception of that conducted at a few special centres, is carried out by sanitary authorities in a distinctly haphazard manner. The work is rarely undertaken energetically, nor are there any regulations to control the system as it exists, except those relating to foreign meat and the recommendations of the Royal Commission of 1898. The former indicate a definite line of action to be taken in certain circumstances; the latter, however, are submitted in the form of advice, and although fairly sound are not entirely satisfactory. Authorities are advised by the Local Government Board to require that inspectors, among whose duties may be included the inspection of meat, shall furnish evidence of competence. But I do not think this is a firm requirement in those districts in which there is only a single inspector. In addition to these deficiencies the fairly general absence of facilities for adequate inspection increases the difficulties, with the result that want of uniformity exists both in the amount of inspection which is undertaken, and in the decisions which are arrived at in comparable cases.

Absence of uniformity of inspection affords opportunities for the practice of much deceit, with the result that both the public and the honest trader are prejudiced. The former finds it possible to sell meat of unsound character; the latter is handicapped in trade by a competitor who takes advantage of the local negligence which he knows exists.

Instances illustrating these facts could be quoted from official sources, and though much remains to be done before a satisfactory system exists, the position is apparently improving, for the Local Government Board in the Report for 1912–13 (p. lvi) state that " of late years public attention has been increasingly directed to the importance of maintaining the purity of meat supplies. Partly as a cause and partly as a result of this, local sanitary authorities

have through their officers, increased the vigilance of inspection." It is probable that this improvement is taking place chiefly in the large urban centres, and in districts where officers who have specialised in public health work are engaged. That there is by no means a universal improvement will be gathered from the consideration of meat seizures in a year in any large area.

## Meat Condemnations in a Well-Inspected Area

As a preliminary to the consideration of suitable figures, and for the purpose of giving some idea of the number of carcasses and the amount of offal which are condemned in a well-inspected area, figures are submitted which relate to condemnations in the private slaughter-houses situate within the area of the City of London at Aldgate. At these places an inspector is always on duty whenever slaughtering is in progress, as also is one or more Jewish officials, whose chief duties are to approve carcasses as Kosher meat, for which purpose a considerable number are slaughtered on these premises. A byelaw is also in force which requires butchers to give notice if they intend to slaughter animals before 7 a.m. or after 3 p.m. on Sundays, and before 6 a.m. or after 9 p.m. on week days. Supervision is therefore constant.

The number of different animals to which the classification relates is: Cows, heifers and oxen, 68,438; calves, 50,288; sheep, 102,912. Of these, 341 whole carcasses of beef and 197 quarters were destroyed as unfit for human consumption, as well as 139 whole carcasses and 21 quarters of veal, and 275 whole carcasses and 28 quarters of mutton. This indicates that about 5 per 1000 cattle are *wholly* condemned, and over 2·5 per 1000 calves and sheep respectively.

The following tables show the number of organs seized among the different animals on account of the principal conditions requiring condemnation in English slaughter-houses.

PRINCIPAL CAUSES OF CONDEMNATION OF ORGANS AMONG 68,438 CATTLE SLAUGHTERED AT ALDGATE.

| Cause. | Heads. | Tongues. | Lungs. | Hearts. | Livers. | Stomachs. | Spleens. | Kidneys. |
|---|---|---|---|---|---|---|---|---|
| Abscess .. .. | 252 | 96 | 242 | 2 | 2202 | 55 | 17 | 10 |
| Actinomycosis .. | 974 | 1366 | 73 | — | — | 2 | — | — |
| Blood aspiration | — | — | 848 | — | — | — | — | — |
| Cavernous angioma | — | — | — | — | 172 | — | — | — |
| Cirrhosis .. .. | — | — | — | — | 324 | — | — | 1 |
| Nephritis .. .. | — | — | — | — | — | — | — | 143 |
| Parasitic diseases .. | — | — | 2065 | — | 5959 | — | 2 | 1 |
| Pericarditis .. | — | — | — | 150 | — | — | — | 2 |
| Peritonitis .. | — | — | — | — | 6 | 61 | 7 | — |
| Pleurisy .. .. | — | — | 2283 | — | — | — | — | — |
| Pneumonia .. | — | — | 434 | — | — | — | — | — |
| Tuberculosis .. | 2699 | 705 | 2806 | 485 | 1338 | 688 | 592 | 794 |

PRINCIPAL CAUSES OF CONDEMNATION OF ORGANS AMONG 102,912 SHEEP SLAUGHTERED AT ALDGATE.

| Cause. | Heads. | Tongues. | Lungs. | Hearts. | Livers. | Stomachs. | Spleens. | Kidneys. |
|---|---|---|---|---|---|---|---|---|
| Abscess .. .. | 8 | 7 | 57 | 23 | 49 | 3 | 21 | 4 |
| Asphyxia .. | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 52 |
| Blood aspiration | — | — | 82 | — | — | — | — | — |
| Cirrhosis .. | — | — | — | — | 6 | — | — | — |
| Emaciation .. | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 60 |
| Hydræmia .. | 70 | 71 | 67 | 83 | 72 | 66 | 71 | 60 |
| Nephritis .. | — | — | — | — | — | — | — | 33 |
| Parasitic Diseases | 2 | — | 2921 | — | 3485 | — | 16 | — |
| Pericarditis .. | — | — | — | 27 | — | — | — | — |
| Pleurisy .. .. | 3 | 3 | 287 | 3 | 3 | 3 | 3 | 6 |

PRINCIPAL CAUSES OF CONDEMNATION OF ORGANS AMONG 50,288 CALVES SLAUGHTERED AT ALDGATE.

| Causes. | Heads. | Tongues. | Lungs. | Hearts. | Livers. | Stomachs. | Spleens. | Kidneys. |
|---|---|---|---|---|---|---|---|---|
| Abscess .. .. | 4 | 2 | 11 | 4 | 70 | 3 | 8 | — |
| Asphyxia .. | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 46 |
| Hydræmia .. | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 22 |
| Nephritis .. | — | — | — | — | — | — | — | 9 |
| Parasitic diseases | — | — | 110 | — | 22 | — | 1 | — |
| Pericarditis .. | — | — | — | 14 | — | — | — | — |
| Pleurisy .. | 1 | 1 | 22 | 1 | 1 | 1 | 1 | 2 |
| Tuberculosis .. | 32 | 57 | 120 | 49 | 112 | 44 | 91 | 76 |

Although the slaughtering of these animals was carried out in private places, the fact that the premises were adjoining and the supervision constant, justifies the assertion that the figures may be taken as representing the average condemnations in a satisfactorily supervised public abattoir. The number of carcasses, parts of carcasses, and organs condemned is sufficiently large to indicate the necessity for effective supervision of the slaughtering of food animals if the interests of the public are to be adequately safeguarded.

## Inadequacy of Meat Inspection

For comparative purposes the number of condemnations in a single year in an area comprising about a million persons has been extracted from the annual reports of the district medical officers of health. All the districts within this selected area are included in the summary, and as there is only one county borough of small size there are no centres from which well-inspected meat can be distributed on a large scale excepting London, which of course supplies a considerable amount of carcass meat to that part in closest contact. The area extends from London to the Channel.

There were 10 urban areas with a combined population of 298,000, and three rural areas with a population of 59,000, in which meat was reported as having been condemned. In the urban districts, the total condemnations were 12 carcasses of meat, three carcasses of mutton, one pig carcass and certain pieces of indefinite character or amount, such as 1 cwt. of pieces of beef and pork; several pieces of beef; parts of the carcasses of eight bullocks, sheep and pigs; a sheep's liver; large quantities of unsound meat; a quantity of meat and 225 lbs. of frozen meat. In the rural districts the condemnations were, one quarter of beef; "the carcass of a strangled bullock;" 50 lbs. of meat; and a "considerable amount of meat."

In 15 urban districts and 5 rural districts with aggregate populations respectively of 173,000 and 68,000, the reports

definitely stated that no unsound meat had been discovered.

In the reports relating to 16 urban districts and 7 rural districts with respective populations, of 236,000 and 184,384, the subject was not referred to, and it is probable that in the majority of these places no unsound food had been dealt with.

Although it is impossible to estimate the number of animals slaughtered in any area in which inspection is only partially carried out, it must be considerable in a population of one million persons, even if it is allowed that 45 per cent. of the supply is frozen or chilled imported meat, and that some home-killed meat in the carcass form is purchased at Smithfield, and the deduction is permissible that the figures stated indicate that meat inspection could not be practised on a much more meagre scale. This fact is further emphasised when it is remembered that of the meat condemned a certain proportion was seized at military camps as a result of inspection by the military officers, since it may be assumed that if a certain amount of meat brought to these camps, with the knowledge that it will be inspected, is found to be unfit for human consumption, the general supply must also contain many more instances than those mentioned. The inadequacy of meat inspection in these selected districts is not exceptional, and I do not believe it is worse than that in similar areas.

As further bearing on this subject, it should be observed that there is the risk of an excess of unsound meat being sold in districts in which meat is not examined, and more particularly when they adjoin or are in close proximity to a large town in which meat inspection is reasonably carried out. After the opening of the public abattoirs in Bury (Lancs.), Dr. Brindley [1] reported that "it has not been an uncommon experience for the owner of an animal condemned by us to tell the inspector that it is the last time he will

[1] "Public Abattoirs," A. E. Brindley, M.D., D.P.H. "Public Health," Vol. XVIII., pp. 442–450.

have the chance of taking any of his animals, and it has been found in each case that no more animals coming from this source have been slaughtered in the abattoirs. One naturally infers that animals from such a man are now sent to other districts where inspection is less thorough." This avoidance of supervision certainly ought not to be possible.

Absence of inspection in circumstances such as these also renders possible a trade in unsound carcasses for use in prepared meats. Such foods are manufactured chiefly from lean meat; and carcasses of old animals which may have suffered from tuberculosis, whilst not marketable in the carcass form, may avoid detection if cut up into small parts, and all evidence of disease removed. That a trade in doubtful meat of this character does exist is undeniable, and it is most difficult to detect. If packed in baskets after being boned, or even loosely thrown into carts, the careless method of transportation supports the contention that it is intended to be used for feeding animals, and it is only when discovered on food preparation premises, or when actually being so transferred, that the evidence of ultimate use is sufficient to justify magisterial proceedings. Such meat can also be so trimmed, or parts selected with sufficient ease, to render it difficult to detect disease. In view of the fact that more instances of ill-effects to the community have been reported in recent years in this country from the consumption of prepared food than of fresh meat, it is desirable that all meat intended for use in the prepared form should be examined and passed before being so used.

## Tuberculous Animals: Question of Compensation

Butchers have long endeavoured to obtain from the State compensation for the condemnation of animals slaughtered for human food which are found to be suffering from tuberculosis.

In 1904 a Select Committee was appointed to consider the Tuberculosis (Animal) Compensation Bill and in their

report attention was directed to the loss which butchers sustain from the seizure of home-bred pigs affected by tuberculosis. Several witnesses had suggested that the regulations were too stringent. The lines on which compensation should be paid if the State accepted the liability were formulated, and these included the requirement of proof that (*a*) the purchase of the animal was made in good faith as to fitness for human consumption; (*b*) there was no proof of illness at the time of purchase; (*c*) a fair price had been paid; and (*d*) notification was made to the local authority as soon as the butcher discovered that he had a tuberculous carcass on his premises.

It is quite improbable that the State will ever agree to give compensation in these cases, as no adequate return would result in the way of eradication of the disease. The condition is, however, so prevalent that the risks may seriously handicap some traders, and although compensation by mutual agreement would appear to present a solution of the difficulty, the differences in the standard of inspection vary so widely that a general arrangement appears at the present time to be almost impracticable. It is obvious that in a well-inspected district a trader would be paid more out of the funds than one in a less inspected district, and so there would result inequality on a basis of equal contributions. Contributions on a differential basis could not be arranged. It is not until a system of meat inspection has been devised which will give more uniform results that voluntary insurance will come to pass. If such a state of affairs existed, butchers might in addition to mutual insurance demand to buy under a guarantee. This would result in cattle breeders being more careful, with all-round improvement as regards stock. At present no guarantee is given by the cattle dealer, for the very good reason that he is able to sell to a butcher trading in an ill-inspected district without such guarantee, and there is no reason why he should sell to one in a better inspected area and accept risks which would involve him in monetary loss.

## Facilities for Adequate Inspection

The subject of improved facilities for the inspection of meat involves a consideration of the condition of existing slaughter-houses, and the policy of providing public abattoirs. Private slaughter-houses have always been regarded unfavourably by those engaged in sanitary work, and attempts have been made to effect improvement but with only partial success. There exist outside the metropolis the following classes :—

(*a*) Slaughter-houses in rural districts which are unlicensed and practically uncontrolled.

(*b*) Slaughter-houses which existed prior to 1875 which were registered with all their defects as regards structure, situation, etc., and which possibly can only be dealt with when nuisance arises, though as regards general management and control they must conform to the byelaws in force in the district.

(*c*) Slaughter-houses to which a licence was granted between 1875 and 1890, the date of the Public Health Acts (Amendment) Act. To these places was granted a non-terminable licence and defects are not remedied without some difficulty, and

(*d*) Slaughter-houses licensed subsequently to 1890, in which case the licence is granted for a fixed period, and if at the termination of the period conditions are not satisfactory, renewal may be refused until improvements are effected.

In London, slaughter-houses have been licensed since 1885, and by the Public Health (London) Act, 1891, the London County Council is the licensing authority. Notice must be given of intention to apply for a new licence, or to renew an existing one, to the Sanitary Authority of the district in which the premises are situate. This enables the authority to show cause against the grant or renewal of the licence, if it so desires.

## Divergent Views on Private Slaughter-houses

Private slaughter-houses are unsatisfactory on the grounds that they are (*a*) objectionably situated, and thus give rise either to nuisance, or are unduly public and contribute to danger from driven animals; and (*b*) that they lack the minimum requirements of general hygienic efficiency and facilities for inspection. Nuisances may be dealt with, but very limited opportunities exist for improvement of defects associated with bad position or absence of inspection facilities. Even in well-built slaughter-houses difficulties arise owing to the fact that the places are often widely separated, and an inspector loses time, and fails to maintain oversight by having to journey from one place to another. This fact was clearly shown by Dr. Brindley,[1] of Bury. During the year 1898–1899 the meat inspector in that town paid 5,026 visits to the 37 slaughter-houses, and yet only succeeded in examining 59 per cent. of the cattle, 29 per cent. of the calves, 19 per cent. of the sheep and lambs, and 54 per cent. of the pigs. This compares with an inspection of 99 per cent. of all animals slaughtered in the town after the establishment of the public abattoirs. It is further of importance to note that although the number of animals slaughtered remained practically the same, double the number of organs were condemned, and the amount of meat destroyed was three times that during the time inspection was conducted in detached slaughter-houses.

Internal conveniences such as light, room, and benches for the careful examination of organs are meagre, and when a carcass is put aside to set for further examination, accidents result in its removal, or the offal, which it is often necessary shall be examined with a carcass, may easily be confused, or wilful substitution may be attempted if the inspector is not present at the time of dressing the carcass. In fact, the last point to be considered in a private slaughter-house is the convenience of inspection.

[1] "Public Abattoirs," A. E. Brindley, M.D., D.P H., "Public Health," XVIII.

As against these objections on the part of the Local Sanitary Authority the trade claim that private places have certain advantages to them.

There can be no doubt that a slaughter-house adjoining a butcher's premises is an advantage. It must be a great convenience to be able to slaughter, and retain the carcasses on the premises until required for sale; at the same time supervision of the general conduct of employees is more easily maintained than would be the case if they worked at a distant abattoir. It is also suggested that the conveyance of carcasses from the place of slaughter to business premises results in more or less injury. In this connection it certainly cannot be argued that cartage improves flesh meat, but the importance of the objection may easily be exaggerated. All imported meat is subjected to much more handling than is home-killed, and at many of the large wholesale markets all meat there deposited for sale is conveyed both to and from in the carcass form. Financial considerations are sometimes mentioned, since slaughter in public places is always subject to a charge which is not the case when a butcher has a slaughter-house attached to his shop, and if he were compelled to cease slaughtering, possibly there would not be an equivalent reduction in rent.

These more or less personal objections ought not to invalidate alternative methods designed more completely to safeguard the interests of the public; but in some instances a good claim can doubtless be made for compensation in the event of compulsory closure after a public abattoir has been established. A slaughter-house to which a non-terminable registration or licence has been granted, and at which trade has developed with this privilege attached, would appear to have established a claim to compensation for disturbance if slaughtering is prohibited on grounds of public expediency. In assessing compensation due regard would be paid to the fact that the privileges and advantages which are enjoyed may be in association with premises which in varying degrees are unsatisfactory

from a sanitary point of view, and thus varying degrees of contribution would result, ranging from a maximum where conditions were satisfactory to a minimum when the existence of the place could not be justified. Hardship would be minimised by giving a sufficiently long notice of intention to close. Terminable licences do not seem to require more than a sufficiently long notice of intention to cease to renew the licence.

It hardly seems possible to reconcile these widely divergent views of the Sanitary Authority and the trade, and there seems no possibility in the near future of public slaughter-houses replacing private places. On the Continent public slaughter-houses have followed State regulations requiring, *inter alia*, that the carcasses of animals intended for human consumption shall be inspected. It follows that if it is necessary for animals to be inspected, they shall be marked in some distinctive manner after they have been passed, and as this work can best be done in public places, the person slaughtering in a private place is handicapped, since he must wait the convenience of the official inspector before he can remove the carcasses. I believe, therefore, that public abattoirs where established would be used freely by the trade if some system of marking, based on official regulations, could be established.

## The Marking of Meat

Some seventeen or eighteen years ago, the question of marking meat was under consideration in a fairly acute form, owing to the development of the imported meat trade. This trade increased as the importation of live cattle declined. In the earlier days much poor quality meat was exported to this country, and then, as now, much inferior home-killed meat was sold. This latter was occasionally sold as "Colonial." The traders in each class of meat were dissatisfied, hence the demand for a distinctive mark.

The marking of imported meat by means of an "Official

Certificate," which is limited to the flesh of the pig, became part of the legal machinery as a consequence of the imported Meat Regulations, 1907, but otherwise the marking of meat is no part of our own official requirements. The marks which are observed on other meat than pork are either the marks of Government Inspectors in the county of origin or traders' private marks.

The official certificate furnishes evidence that the pig from which the meat is derived has been certified by a competent authority in the place of origin to be free from disease at the time of slaughter, and to have been dressed, prepared and packed with the observance of all requirements to prevent danger arising to the public health from the use of the meat as an article of food. It does not exempt meat so certified from liability to inspection.

In the cities of Belfast and Exeter, and the Burgh of Hamilton, the marking of meat is being undertaken as a local measure, and to some extent by arrangement between the butchers and the local authority. The chief danger to be apprehended from the general extension of similar arrangements is that each district will arrange its own standard, and as these may vary, uniformity will not be obtained. For this reason also the mark may not be accepted as proof of adequate inspection, and the only satisfied parties will be those in the district which has approved the system.

Uniformity of practice and decision are the first essentials in any system of meat marking, and this can only be obtained by Government supervision. Such a system would necessitate, furthermore, that officials who may be empowered to inspect and mark should be competent accurately to interpret the spirit and to determine the significance of regulations, since no series can be compiled which will give a dogmatic ruling to meet every contingency. Proof of adequate knowledge would be essential before appointment.

Adequate facilities for inspection would also be necessary. In many districts the want of facilities would prove a barrier

at the present time to general meat marking. The difficulties would be greatest in rural districts where slaughter-houses are widely separate, and in which slaughtering is conducted at irregular intervals. In districts provided with a public abattoir the additional labour would prove insignificant.

It has been suggested that the use of central clearing-houses would prove a suitable middle course between inspection at the time of slaughter and inspection in shops. It is true that such a provision would be valuable, but only if the offal were brought to the central station still attached to the carcasses, as is required in many continental cities, otherwise there would practically be no difference between the inspection at a clearing-house, and at a wholesale market. To agree to mark carcasses in these circumstances would be a retrograde step, as the examination would be often unreliable, and the hurry and stress of obtaining release from a busy clearing-house would result in ineffective examination even with the provision of a large number of inspectors.

It is quite obvious that the introduction of meat marking would alter the fundamental principles of responsibility which attach to the existing system, *i.e.* from the standpoint of diseased conditions. At the present time the butcher is responsible for the soundness of the meat he sells, and the inspection is a kind of detective method which attempts to discover him in default. Often no excuse is accepted for the difficulties associated with the case. This responsibility is one which should devolve upon the inspector, who should examine each carcass and approve or reject it. Having approved it, an owner ought to be absolved from blame if disease is discovered in the later stage, say when cutting up the carcass. Unless meat is marked after an inspection carried out in circumstances which admit of all evidence of soundness or disease being available, and that is not possible in a wholesale market, the mark would involve the inspector in responsibilities beyond what the circumstances justify. There would be an increasing tendency to

this end, for persons of doubtful integrity might prefer to submit diseased carcasses to this central inspection rather than to slaughter-house inspection, and thus gain a possible advantage.

### Suggested Scheme

I am satisfied that the want of uniformity, the scarcity of competent inspectors, and the absence of facilities would render a universal system of compulsory meat marking impracticable at the present time; but nevertheless I consider that the advantages to be derived are so considerable that a system on an adoptive basis under Government control would prove of value, and lead to the adoption of a general system in the future.

I suggest that it would be a desirable step for the Local Government Board officially to approve a system of meat marking, and for that purpose decide upon the nature of the mark, and the manner of marking, and also take steps to safeguard the use of the mark only by a recognised authority. The use of the mark should be limited to carcasses examined at the time of slaughter.

The power to use such mark should only be granted on request, and after the Local Government Board are satisfied that the local authority making the request may reasonably be expected to maintain satisfactory inspection of meat. Such permission should have regard to the number of inspectors employed, their competence to carry out the work and the facilities which are available. Powers should likewise be granted to make a charge for this service: a maximum being stated. If this charge is allowed, it should be within the power of any butcher slaughtering within the district of an authority empowered to mark meat, to require the local authority to examine and mark the carcasses of all animals slaughtered by him, if he enters into an arrangement with the authority and pays for the services thus rendered. It is probable that in districts provided with a public slaughter-house no charge would be necessary, but

in large urban districts unprovided with a public abattoir, an addition to the inspectorial staff might be required, and the charge would help to cover the cost of the extra help if the increased advantages to the public were not regarded as an adequate return. In most rural districts more or less concentration would be necessary, and if this did not exist marking would not be practicable. This would be a fairly general condition of affairs at first, but I am of opinion that if the public is educated to appreciate the value of marked meat, an increased demand would arise for this meat, with perhaps a slight increase in value, and in both rural districts and in those urban districts with numerous scattered private slaughter-houses, the butchers themselves would ultimately ask that public abattoirs be provided to enable the local authorities to carry out the additional inspection which marking would entail.

Power should be granted to authorities who have been given permission to mark meat to require, in the case of prepared foods used for human consumption in such area, that only marked carcasses shall be used for that purpose.

If the Local Government Board arranged for the recognition of marking, a more or less detailed system of inspection would require to be formulated, and this of itself would prove a marked advance in meat inspection.

## Regulations as affecting Meat Inspection

Very little progress in meat inspection can be expected until official regulations to control the work have been issued. Among other matters a complete series would provide for (*a*) the manner of conducting both ante-mortem and post-mortem inspections ; (*b*) instructions as to action to be taken if unsoundness is discovered ; (*c*) suggestions as to the disposal of unsound carcasses ; (*d*) requirements as to sanitation, provision for enabling inspections to be carried out, and qualifications of inspectors ; (*e*) regulations respecting the hours of slaughtering in places where control

can be arranged; and (*f*) the requirements to be observed before a carcass is marked, if "marking" is officially approved.

In the first place, inspection—as far as may be practicable—of all meat intended for human consumption should be a compulsory duty imposed on Urban Sanitary Authorities.[1] In rural districts it should be a requirement that at least those slaughter-houses in which animals are slaughtered for consumption outside the sanitary area in which the place is situate should be licensed, and that regular inspection of animals slaughtered therein should be practised. With the development of a system of marking it would be possible at a later date to require that the carcasses of animals intended for another district should have been inspected and marked before being transferred.

It is also essential that men engaged on meat inspection work should be competent for the purpose. It would appear that any development in this direction would require that there should be two grades of inspectors, viz. an expert officer who would not only appreciate the reason for any particular regulation, but who would be capable of forming

[1] The requirement that a local authority shall undertake the inspection of meat is only indirect, and is contained, as regards districts outside London, in the General Order of the Local Government Board of December 13th, 1910, in the Articles referring to the respective duties of Medical Officers of Health and Inspectors of Nuisances. Similar requirements affecting areas to which the Public Health (London) Act, 1891, applies, are contained in the Order of December 8th, 1891. The respective wordings are as follows:—Outside London. An Inspector of Nuisances "shall from time to time, and forthwith upon complaint, visit and inspect the shops and places kept or used for the preparation or sale of butchers' meat . . . and examine any animal carcass, meat . . . which may be therein . . . etc."

A Medical Officer of Health "in any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the Council . . . shall himself inspect and examine any animal carcass meat . . . etc."

In London, the requirement to inspect meat, etc., is similar in terms.

It appears to me that this instruction is of such a general character that the performance of a minimum amount of supervision or inspection of meat would exculpate an inspector from any charge of apathy in this connection which might be brought against him.

a judgment on conditions not specially provided for; and a second group who would correspond to the lay inspectors of foreign countries. These would require to be able to recognise diseased conditions and be competent to give a decision in certain instances and to recognise that in others the opinion of one more skilled is necessary. Sanitary inspectors, provided they have undergone a special training, might be trusted to do this latter work; and as regards the former, it is becoming more and more the practice for large public health departments to appoint a veterinary officer. When the new milk legislation comes into operation the scope of the veterinary profession in this connection will be increased. Proper supervision would not appear, therefore, to be a matter difficult to organise. It would require that all local authorities should have on their staffs inspectors competent to undertake ordinary routine inspection—this could be made a requirement as future vacancies arose—and that County Councils should arrange that the rural areas and smaller urban areas should have available the services of their veterinary inspectors for expert decision in cases where doubt exists, or where support in probable legal proceedings is necessary, or even for general supervisory work. In the matter of competence, the ordinary veterinary surgeon and the general medical practitioner are not necessarily experts; both, however, have the necessary fundamental knowledge, and given special instruction and a certain amount of experience, each should be able to acquire rapidly the necessary skill.

## Regulations respecting Unsound Meat

The value to the community of regulations would obviously depend upon the skill of the executive officers, and the energy displayed by local authorities in giving effect to them; but even with the best organisation some unsound meat would escape notice. That this need not be a large proportion is proved by experience in the examination of imported meat.

In practically all meat exporting countries regulations have been framed to guide the inspectors, who generally are appointed by the respective Governments. Regulations exist in Australia, New Zealand, Argentina, the United States of America, Holland, and other places. A considerable amount of carcass meat from these countries passes through London, and at Smithfield Central Market probably more is cut up on a limited area than anywhere else in the world. The cutting up process brings to light hidden defects, and the experience gained there is of interest.

The amount of tuberculous meat discovered at Smithfield among the South American imported carcasses during the past four years is set out in the following table.

| Year. | Amount received in tons. | Amount condemned on account of tuberculosis. |
|---|---|---|
| 1912 | 140,179 | 43 hind-quarters, 8 fore-quarters, and 25 pieces. |
| 1913 | 154,503 | 27 hind-quarters and 10 fore-quarters. |
| 1914 | 143,910 | 34 hind-quarters and 11 fore-quarters. |
| 1915 | 92,212 | 26 hind-quarters and 5 fore-quarters, and 2 pieces. |

The totals condemned are insignificant, and do not much exceed what might be expected from ordinary defects of administration. They do not include any meat condemned other than for tuberculosis. That this freedom of the carcasses from tuberculosis is not due to absence of disease among the stock will be gathered from the fact that Mr. T. Dunlop Young,[1] reporting on the subject of Argentine meat as a result of a visit to that country with the authority of the Corporation of London, states that during 1912, out of 1,368,000 cattle slaughtered at the Frigorificos, and mainly for export, 4 per cent. were affected with tuberculosis, a total which would exceed 54,720 cattle.

Some figures are also available respecting Dutch pigs, and though they are incomplete, they support the present contention. In a period of nine weeks, 43,330 pigs, or about one-sixth the total received at Smithfield, were specially

[1] Report to the Sanitary Committee of the Corporation of London by T. Dunlop Young, M.R.C.V.S., Veterinary Surgeon, on his visit to the Frozen Meat Establishment in the Argentine Republic.

reported on. Among these, thirty-nine carcasses were seized. None of these seizures were necessary on account of tuberculosis; nine were rejected on account of decomposition; one for hæmorrhagic spots, and twenty-nine for other reasons not associated with disease. Five carcasses from this consignment had already been seized at the Port for reasons which could not be then ascertained; but assuming these were on account of disease, the total is not large, and tends to prove that inspection carried out on formal lines, though not resulting in absolute perfection, brings about the elimination of much animal food unfit for human consumption.

These results, both as regards the carcasses of oxen and pigs, are much better than would have been observed among an equal number of home-killed animals, and this is due mainly to the differences in inspection, and to the greater uniformity of action which follows the discovery of unsoundness where regulations are in force.

## The Three-Standard Basis of Meat Inspection

In framing regulations there would result certain marked differences between those of this country and those in operation in other European countries, and in the United States. A two-standard basis has always been the first principle of our meat inspection work, whereas in other European countries there is a three-standard basis, and in the United States there are the first elements of a third standard superimposed on the general two-standard. In this country meat is either fit for human consumption or it is not; but on the Continent an intermediate grade of non-marketable meat exists, and provision is made for the sale of some of this meat, subject to its being sold under declaration, and either with or without its first having undergone some approved form of treatment. In the larger towns, the intermediate grade is sold only after it has been treated by boiling, steaming, the removal of fat and destruction

of the rest of the carcass, pickling or freezing. By this means the flesh of selected animals which have suffered from varying degrees of tuberculosis, swine fever, swine erysipelas, certain febrile conditions, measles, etc., is rendered safe for human consumption.

In the United States, flesh from a tuberculous carcass which is regarded as being affected in a degree intermediate between what requires total condemnation and that which justifies a carcass being regarded as fit for human consumption, may be passed for sterilisation after removal of the affected portions. Meat passed for sterilisation may only be sold for human consumption under declaration. The carcasses may be rendered into lard or tallow, or if not so treated may be sterilised and used for food purposes, but presumably only as canned meat, and provided the container is plainly and conspicuously marked so as to show that the product is second grade class or quality and has been sterilised. Provision also exists for the use of beef and pork showing a certain degree of measles, and of carcasses affected to a minor extent with swine fever.

It is doubtful whether any except the two-grade standard would be acceptable in present circumstances to the inhabitants of this country, and as regards details, definite rulings could easily be laid down which would be generally acceptable in the majority of defects. Consideration would, however, require to be given to decisions which would be necessary in special instances,[1] such as actinomycosis of ox heads, particularly when the tongue is free, and the disease localised and without suppurating fistulous tracts; immaturity in calves; jaundice; new growths and parturient animals. These are quoted as examples; but perhaps the most important requirement is that of guidance in connection with tuberculous lesions in both the ox and the pig. The subject merits detailed consideration.

[1] See Appendix III., p. 128.

## CHAPTER III

# THE TUBERCULOSIS PROBLEM AS AFFECTING CATTLE

Frequency of tuberculosis among cattle slaughtered for human consumption—Recommendations of the Royal Commission—Manner of extension of tuberculosis—The paths of infection in cattle—Congenital tuberculosis—The various types of acquired tuberculosis—Significance of miliary tuberculosis in relation to meat inspection—Consideration of the Royal Commission's recommendations—Suggested course of action to be taken in the case of tuberculous carcasses.

It has already been shown that tuberculosis is the reason for condemnation of a large proportion of the organs of slaughtered cattle, and similarly it is the chief cause of condemnation of whole carcasses. Out of a total of 68,438 animals slaughtered at Aldgate, the carcasses of 341 were totally condemned, and of these the reason was tuberculous affection in 319 or 94 per cent. Among 50,288 calves, 139 carcasses were condemned, of which 41 or 30 per cent. were on account of tuberculosis.

A division of the animals affected with tuberculosis is of interest, and the following tabulation shows the high incidence of the disease on cows, in which animals it amounts to over one-third.

Incidence of Tuberculosis, in any Degree, on Animals slaughtered at Aldgate.

| | No. slaughtered. | No. affected with tuberculosis. | Percentage affected with tuberculosis. |
|---|---|---|---|
| Bulls .. .. .. | 2,565 | 381 | 14·9 |
| Cows .. .. .. | 4,434 | 1,492 | 33·7 |
| Heifers .. .. .. | 1,079 | 68 | 6·4 |
| Oxen .. .. .. | 48,953 | 1,872 | 3·9 |
| Calves .. .. .. | 39,333 | 121 | 0·31 |

The degree of affection is shown to some extent by comparing the percentage of total condemnations of carcasses to numbers affected with tuberculosis, thus :—

| | Total No. of animals affected. | Cases in which the whole carcass was condemned. | Percentage. |
|---|---|---|---|
| Adult bovines .. | .. 3,813 | 319 | 8·4 |
| Calves .. .. | .. 121 | 41 | 33·9 |

Although more fully developed animals were affected with the disease than were calves, the latter showed a higher percentage of dissemination than the former.

## The Question of framing of Satisfactory Regulations

The guiding principles regarding the action which shall be taken in the case of tuberculous meat are laid down in the Recommendations of the Royal Commission. A considerable want of uniformity is, however, observed throughout the country, which is due, in great measure, to the fact that the Recommendations are only suggestive, and therefore allow scope for the exercise of personal opinion. This divergence of views has been objected to in the past by traders, but has been tolerated. Probably the very low cost of meat has contributed to the tolerance under protest. Indications are not wanting, however, which suggest that meat may have touched the lowest point in price, and that possibly the increase in price observed in recent months will be permanent if only in part. The first result of such increase will be that the condemnation of a carcass will be of greater import financially than formerly, and differential treatment will have a more marked effect. The increased value of the carcass will also encourage deceit, to meet which, more complete arrangements for inspection will be necessary.

The problem of framing entirely satisfactory instructions in the case of tuberculous meat is not an easy one, as will be gathered from a consideration of the subject.

When an animal has been successfully invaded by the

tubercle bacillus two conditions, at least, result from the development of the disease. The function of the affected organ is diminished in proportion to the extent of the lesion, and the constitution of the animal is prejudiced as a result of the absorption of poisonous products gaining access to the blood stream from the lesion. Further progress results in the specific organisms getting free from the original site of infection and ultimately gaining access to the blood stream. If the number of organisms is small, possibly they are destroyed; but if large, and particularly if frequently liberated, they reach other organs, where some are embolically removed and give rise to characteristic lesions. Those which escape a particular organ may be arrested in another organ or be destroyed in the blood. This extension of infection results in an increase in the severity of symptoms. It is obvious that the animal should be regarded as diseased from the time of infection. The disease is furthermore one to which human beings are liable, and it becomes, therefore, a matter for consideration whether the flesh of animals so affected shall be prohibited for human consumption; either because it may transmit the disease to persons partaking of it, or because the flesh takes on qualities which may render it of low nutritive value, or may even have had imparted to it some quality other than that of direct disease transmission, which may prove prejudicial. Even if all these possibilities exist it is clear that there are degrees of risk, varying between that resulting from the earliest infection to that which follows the more developed and multiple lesions.

In the latter case there can be no doubt about the unsuitability of the carcass for human consumption, but in the former the risks and other objections may be so slight as to be negligible. The Recommendations of the Royal Commission approve the principle that there are degrees of tuberculous infection which do not necessitate destruction of the whole carcass but it is obviously impossible to indicate with absolute precision the point at which a carcass

becomes unfit. That being so, and the view being held that the risk may only be disregarded in certain degrees of infection, it becomes necessary, if a rule is to be framed, that it will relegate the uncertain cases to the group which are regarded as definitely harmful, so that the consumer may have the benefit of any doubt.[1] The Recommendations of the Royal Commission are as follows :—

| | |
|---|---|
| 1. When there is miliary tuberculosis of both lungs.<br>2. When tuberculous lesions are present on both the pleura and peritoneum.<br>3. When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles.<br>4. When tuberculous lesions exist in any part of an emaciated carcass. | The entire carcass and all the organs may be seized. |
| 5. When the lesions are confined to the lungs and the thoracic lymphatic glands.<br>6. When the lesions are confined to the liver.<br>7. When the lesions are confined to the pharyngeal lymphatic glands.<br>8. When the lesions are confined to any combination of the foregoing but are collectively small in extent. | The carcass, if otherwise healthy, shall not be condemned; but every part of it containing tuberculous lesions shall be seized. |

" In view of the greater tendency to generalisation of tuberculosis in the pig, we consider that the presence of tubercular deposit in any degree should involve seizure of the whole carcass and of the organs."

[1] A trader might here raise the question whether in case of doubt, he ought not to be compensated for the loss of a carcass, since the condemnation is in the interests of the public. These instances will be so infrequent, however, that it is improbable that any notable injustice will be inflicted.

## Generalisations as to Mode of Extension of Infection

Principles would form a better basis of action than detailed statements provided competent inspectors existed to interpret them, and the following generalisations, which have some bearing on the case, may be briefly considered.

Infection may reach the system through the respiratory or digestive tracts, and less frequently by the generative organs, or as a result of inoculation through the skin. Instances of congenital infection are also met with.

Having gained access to the system, further extension may take place by way of the lymphatic system, or the blood stream, or both. Tuberculous discharges thrown off by the animal from the seat of infection may also infect more distant mucous surfaces, as, for example, the urinary tract below the kidney from urine secreted by a tuberculous kidney, and the larynx or intestines by infected sputum thrown off from a tuberculous lung.

In the case of extension along the lymphatics, it seems unlikely that much extension, if any, can take place in a direction opposite to that of the lymph flow, which is from the organ drained to the corresponding gland, and from the gland to the central lymph channels—the thoracic duct on the left side and the main lymphatic duct on the right side. Infection of healthy glands away from the original infecting lesion may result as a consequence of their being placed along the line of lymph flow and receiving infected lymph. In certain instances it is not always possible to assert confidently that one gland has infected another, or that the flow in the smaller lymph vessels is invariably in one direction. This is due to the fact that the exact area drained by certain glands cannot be stated with absolute certainty, and also that there are most numerous anastomoses between lymph vessels in fairly well defined areas. Take, for example, the glands draining the throat and neck. In this case the share taken by the submaxillaries, parotids, retro-pharyngeals, and the remaining cervical glands cannot be stated otherwise than in

general terms. These glands also have many inter-communicating channels. From this it follows that one or more glands may be infected from a common source of infection, and no deductions can be drawn with certainty as to the sequence. Fortunately it is practically never necessary for a meat inspector to make such a fine distinction. Similarly in the case of the lumbar glands. These receive lymph from practically all the glands which drain the abdominal cavity, and the muscular and bony structures of the abdominal walls and of the hind extremities, so that infection of them would, if considered alone, be unproductive of suggestion as to the original seat of infection. On the other hand, there are glands respecting which a fairly positive statement may be made that lymph entering them has been received from a well-defined area, and if such a gland shows a tuberculous lesion, that the infection was derived from the area drained. Such glands are those connected with certain organs, particularly the portal gland, the renal gland, and the external inguinal or supra-mammary gland according to sex. There are others which receive lymph only from the muscles, bones, and joints of the extremities, *e.g.* the prescapular, the precrural, and the popliteal, and infection of these has a similar definite significance. Obstruction to the flow in a system with such marked anastomotic features will, therefore, on occasions show almost unexpected variations to improve any impaired efficiency. For example, the lymph of the pleural region normally reaches the main lymph channel either direct or through the pre-pectoral glands; but as pointed out by Buckley and Castor,[1] in case of obstruction, the lymph vessels may become fused with deep-lying lymph vessels on the pectoral wall, and these in turn pass over the shoulder to the prescapular glands. This is a roundabout course, and probably rarely if ever happens, but it serves to illustrate the point, that surprising variations in flow may be noticed, and infection be transferred to

[1] Buckley and Castor, "Lymph Glands of Food Producing Animals." 27th Report, Bureau of Animal Industry.

unexpected situations. Another example, but as a normal condition, is found in the case of the pig, in which animal (and perhaps also in cattle) a small part of the fundus of the stomach drains into the splenic gland, from which it will be gathered that tuberculosis of the spleen may cause lesions in one or more of the multiple gastric glands without the stomach being the seat of origin.

The venous blood stream receives infection from infected lymph, which enters by way of the thoracic duct or right lymphatic channel, or by the infection gaining direct entrance through the erosion of a vein which has become implicated in a tuberculous process either within a gland or otherwise.

Having reached the blood stream, the bacilli are conveyed to the lungs (except in the case of the portal system, to be later mentioned), and from thence may pass into the arterial blood stream to reach other organs. The organs apparently do not show uniformity in results. The lungs are most generally affected, as would be expected, and next most frequently the liver. The spleen [1] and kidneys may be affected, but the latter more frequently. Muscular tissue rarely shows lesions, whilst bony structures are much more frequently affected in pigs than in cattle. The brain and spinal cord are infected from the blood stream. The reasons for these differences in glandular structures may be found in the varying amount of blood transmitted to them, differences in the speed of flow, and perhaps the action of the gland contents on the organism.

The blood itself seems able to get rid of organisms or to destroy their pathogenicity in a few days, as has been shown by McFadyean and others, and in this, the filtering action of the various glands assists; but there is also a direct lethal effect, and probably excretion is not a negligible factor.

[1] Lesions rarely develop in the substance of the spleen in cattle infected after calf-age.

## The Paths of Infection in Cattle

The terms "localised" and "generalised" are used in meat inspection in connection with the distribution of tuberculous lesions. They are, however, not entirely satisfactory, for if they are strictly interpreted they are not of sufficient significance; and on the other hand, if they are given an extended meaning, confusion may result. I prefer to use the words "primary" and "secondary" lesions, and assume that primary lesions are always found in situations which admit of infection having been received from outside the body, *e.g.* the lungs, mesenteric and cervical glands, the external genital organs and local inoculations. The secondary lesions are extensions from the primary lesions, from which latter the infection is conveyed by way of (*a*) the various tracts of the body, such as the respiratory or digestive tract (auto-infection); (*b*) the lymphatic system; (*c*) the venous blood stream; and (*d*) the arterial blood stream. In arriving at a decision as to the action which should be taken in any particular case, I endeavour to locate the primary lesion and to decide along which course the infection causing the secondary lesions has passed. It is not always possible to arrive at a definite decision, but in case of doubt the more serious of the alternatives is the one accepted.

In the bovine, the seat of the primary lesion varies with the age of the animal. In calves of four or five weeks old tuberculosis is not common, but it is by no means infrequent, and such cases as I have seen have been mostly of the congenital type. In these cases the primary lesion is to be sought in the maternal system, and the secondary lesions are distributed to the calf by the maternal arterial blood. The cases which are not congenital among these very young animals are of the ingestion type, in which early lesions are found in the mesenteric glands, and less frequently in the cervical glands or both. These cases, also, are not numerous. At a little older age, but with very few instances under ten weeks, the regular type of cattle, primary pulmonary, is met

with, whilst at a still older age the primary ingestion cases diminish in numbers, and the pulmonary type is almost the only one observed.

The course of infection can only be followed with certainty by observing the lesions in very young animals. These, with few exceptions, are not killed on account of illness, but in the course of preparation for human food, and thus the early unsuspected cases come under observation.

**Congenital Tuberculosis.**—In the fœtal circulation the arterial blood passes mainly through the abdominal organs. Very little reaches the lungs and that only at a later stage in the circulation. The obvious deduction is that in such circumstances blood charged with infection will mainly affect the liver, spleen and kidneys, and the lungs little if at all. No primary lesion is observed, and all lesions are of the miliary type. In addition, the size of the deposits varies in groups, indicating different stages of growth due to release of infection at different times. As regards extent of infection, the mesenteric glands show no deposits, the greatest number of centres are in the liver, the kidneys show the fewest, and the spleen a number intermediate between the two. The kidneys sometimes escape, so far as may be judged by careful macroscopic search. When slaughtered at the age of four weeks, the largest lesions are about a quarter of an inch or even more in diameter in the liver and spleen, but rather less in the kidney, as they are not so flattened out as are the splenic lesions. There are often many minute spots observed in the liver which appear to suggest a very recent dissemination. These minute spots are not so easily seen on the spleen owing to the nature of the covering, they are seen in fewer numbers occasionally on the surface of the kidney. This later dissemination has passed through the lungs into the arterial stream, and the lungs show early centres of infection of the miliary type. These are small, many are sub-pleural, and in that situation are about an eighth of an inch in diameter, translucent and obviously

tubercles much younger in age than those earlier ones in the abdominal organs. Their origin is due to lymph infection conveyed from the abdominal organs and the related lymphatic glands. They reach the lung either by direct entrance into an eroded vein in the affected organ or lymph gland, or by infected lymph which reaches the blood stream by way of the main lymph tract. From the lungs the infection is carried in the arterial blood to the system generally. If the dose of infection has been severe, lesions will be found in the lymph glands of the carcass, most often the external inguinal, and prescapular.

This represents the course of events in the congenital cases. If the calf is not slaughtered till a later age, all the lesions develop and auto-infection may set up deposits in the mesenteric and perhaps cervical glands, and so a stage arrives when it becomes impossible to differentiate the case with certainty from one of primary intestinal origin with later dissemination. (This would not really matter to the meat inspector as regards his decision, since the distribution would be sufficient to require condemnation.)

**Acquired Tuberculosis.**—In calves up to the age of ten weeks the abdominal type, although not common, is more frequently observed than the pulmonary. This observation does not agree with the experience of Chaussé. The primary lesion is more generally found in the mesenteric glands than the cervical. Sometimes a double infection is noted.

*Abdominal Type.*—The mesenteric glands may be affected alone, but the liver soon shows miliary lesions, and the portal gland becomes affected. The infection is conveyed to the liver by radicles of the portal veins. Further development results in miliary deposits in the lungs conveyed by the venous blood stream in the manner already described. The next advance is infection of the arterial stream by way of the lungs resulting in secondary deposits in liver, kidneys and systemic lymph glands and perhaps spleen. All or only some of these may show lesions.

*Cervical Type.*—The cervical glands may show infection

alone. Later, miliary tubercles may be found in the lungs, due again to infection conveyed by the venous blood stream. Subsequent development follows infection of the arterial blood stream with results as in the last example.

*Double Primary Infection of the Cervical and Mesenteric Glands.*—In this instance, the only difficulty is the decision whether the liver lesions are due in part to secondary infection by way of the arterial blood, or whether they entirely arise from infection conveyed by the portal system. If from the arterial system, lesions indicating at least two different ages will be observed, and the fact is rendered decisive if lesions are in addition found in the kidney, systemic lymphatic glands, or spleen.

*Pulmonary Primary Lesions.*—This is by far the most common form of invasion of cattle by tuberculosis. The development of the disease is easily followed.

The lungs may show a primary lesion without macroscopic evidence of tubercle in any other organs, but extension soon occurs, and the following possibilities are to be noted :—

(1) Extension of the disease by the lymphatic tract to the glands in the mediastinum.

(2) Auto-infection by swallowing infected sputum which may give rise to lesions in the mesenteric glands, or in one or other of the cervical glands.

(3) Infection of the arterial blood stream by way of the pulmonary artery and the left side of the heart ; and

(4) Extension of the primary lesion by the development of tubercles around the periphery of the primary lesion. There may be more than one primary lesion observed in the lungs.

A few observations are desirable respecting this classification.

(1) *Development by the Lymphatic System.*—One or more of the mediastinal and bronchial glands soon become infected from the lungs, and they at a later stage may infect the venous blood stream in the manner already stated.

In this manner the lungs become infected secondarily with miliary tubercles in addition to their being the seat of the primary lesion.

The bronchial and mediastinal glands appear to have a direct relationship with the pleural cavity. Possibly this space is lubricated with lymph supplied by these glands, and they may likewise drain off excess. If that be the case it would account for the frequency of tuberculosis of the pleura, which is often seen in considerable amount in relatively early cases of tuberculosis. The remarkable extent of infection of the pleura is probably the result of friction, since the lubricating medium in an infected state is passed backwards and forwards over the pleural surface. It is interesting to note that pleural tuberculosis is a late manifestation in pigs, which is what one would expect, seeing that the origin in pigs is generally due to ingestion. The comparative line of development in the bovine and porcine is :—

| *Ox* | | *Pig* | |
|---|---|---|---|
| Lungs (primary). | | Cervical or mesenteric gland (primary). | |
| Mediastinal glands<br>Pleura | Lymphatic extension. | Lungs (miliary). Blood stream extension. | |
| | | Mediastinal glands<br>Pleura | Lymphatic extension generally *via* the lungs, but infection may at time be conveyed by the blood stream. |

In the ox the disease has frequently not extended by the blood stream at the time of pleural attack, but in the pig it has ; thus the lung affection following cervical infection would be of the miliary type, and so, probably, tuberculosis of the type disseminated by the arterial blood stream would be

developing at the same time as the pleural lesion. Pleural lesions in the pig, in cases not of primary pulmonary origin, are therefore nearly always associated with dissemination.

The extension from the pleura is to the subdorsal and supra-sternal lymph glands with possible future increase of infected material passed into the venous blood channel, and so increasing the lung affection.

(2) Auto-infection from the lungs would result in development of either mesenteric or cervical lesions with subsequent development as already suggested.

In this connection it is only necessary to state that, as in the case of the pleura and the mediastinal glands, the peritoneal cavity appears to be related to the mesenteric glands, and infection of this cavity may follow infection of these glands, and the extraordinary development of the disease may likewise also be due to friction.

(3) and (4). *Development by way of the Arterial System; and extension of Tubercles round the Primary Lesion.*—The tendency of tuberculosis in cattle is towards the establishment of a chronic condition rather than an acute. This shows itself in the formation of delimiting fibrous tissue around the primary lesion and degenerative processes in the material enclosed, which often becomes caseous and calcified. This enclosing tissue would appear to prevent much extension by way of the arterial system from the average primary lesion. (Occasionally there must be an escape, but not always enough to set up a lesion in other organs, though at times even this happens, but dissemination in such cases would generally be slight in amount.) On the other hand, tubercles develop as a result of infective particles forming emboli in the lung capillaries. There is more probability of escape of infection into the arterial blood supply at the time the emboli form in the lung than during the later growth of the tuberculous foci, and therefore cases of miliary tuberculosis are more likely to be associated with dissemination by the arterial system than are primary centres. Primary centres, however, may take on more

acute development and tubercles may develop at the periphery. The risk of dissemination in such cases is probably equal to that of growing embolic centres, but less than that which results from the release of infection which gives rise to miliary lesions. The risk is greater than is observed in the chronic type of primary lesion. Miliary tuberculosis of the lungs is therefore the condition which most frequently renders a whole carcass unfit for human consumption; acute primary lesions with evidence of recent active growth are next in importance, and chronic primary lesions of least importance.

It does not always follow that the dose of infection which sets up miliary tuberculosis in the lungs is sufficient also to set up lesions in the organs beyond. There is some general relationship between the extent of pulmonary deposit and the probability of deposit in other organs. If the animal lives for some time after the infection has escaped into the blood stream, growth in both lungs and organs will continue, and at the inspection the probability of simultaneous infection can be ascertained. From the meat inspection point of view, therefore, account requires to be taken of the age of the miliary deposit in the lungs, and the extent. Early deposits must be regarded as dangerous, whilst in older cases the actual location of the distal lesions becomes a more decisive factor. In recent cases, if the lesions are limited to one organ beyond the lung, there seems to be very little risk in passing the carcass; and if two organs are involved, but the deposits are old and not numerous, the same deduction appears to me to be justifiable. In cases where doubt arises an examination of the systemic glands of the carcass assists in the decision.

The organs affected by the blood stream are the liver (not forgetting the possibility of portal infection), the spleen, the kidneys, the internal genital organs (with the proviso that the interior of the uterus may be infected from the peritoneal cavity along the Fallopian tubes), the bones, joints and muscles. The systemic glands which may be affected in

arterial extension are mainly the prescapular, the precrural, the external inguinal or supra-mammary, the popliteal, and probably the ischiatic (this is never examined). Although infection of these lymphatic glands is generally indicative of arterial dissemination, the possibility of inoculation tuberculosis should not be overlooked. In these cases infection of the gland may arise by way of the lymph stream, and the position is that of a localised infection. Instances of this are not frequent in meat inspection work.

## Consideration of the Recommendations of the Royal Commission respecting the Condemnation of Tuberculous Carcasses.

The recommendations of the Royal Commission, so far as they relate to tuberculosis observed in the carcasses of cattle, may be considered in detail at this point.

*The entire carcass and all the organs may be seized—*

1. *When there is miliary tuberculosis of both lungs.* Miliary tuberculosis does not arise as a primary manifestation, nor does miliary tuberculosis except on rare occasions affect one lung only. It is an incident in the development of a primary lesion which has formed in one of the positions already stated. The new tubercles around an actively-growing primary lesion in the lungs are not embolic in origin, and therefore do not give rise to the same risk of dissemination by the arterial blood stream as do lesions of the embolic type. Miliary tuberculosis of the lungs results from infection of the venous blood stream, and is the most serious lesion in tuberculous carcases, but for reasons stated this recommendation seems too exacting, as, I believe, some carcasses so affected may justifiably be saved.

2. *When tuberculous lesions are present on both the pleura and peritoneum.* Lesions so situate are no proof that the infection has either been conveyed by the arterial or venous blood supplies. They may, in my opinion, be entirely lymphatic in origin, as already described. In general, the rule

as it stands is sound, owing to the extensive character of the lesions making it impossible to remove the affected tissue; to the consequent effect on the system generally; and to the probability of many lymph glands being implicated, rendering complete investigation a matter of considerable difficulty. Nothing, however, is said in the recommendations respecting affections of one or other serous surface separately. They are, in my experience, not affected without other associated lesions, that is, the pleura without one or more of the lymphatic glands in the mediastinal space, and the peritoneum without an associated lesion in the mesenteric glands. Probably one serous surface may also be affected by the other by directly intercommunicating lymph channels on the diaphragm, or the pleura from the peritoneum by the roundabout way of the posterior mediastinal gland, which receives lymph from a part of the upper surface of the liver.

In the case of affections of the pleura, I am of opinion that total destruction of the fore quarter is not necessary in every case. Provided the lesion on the parietal pleura is single, of limited extent, say not more than the size of the palm of the hand in area, and the subdorsal and suprasternal glands show no signs of infection, I think it would suffice to remove the part of the chest wall on which the lesion is located, together with a fair margin extending beyond; in addition, the remaining parietal pleura should be stripped, but this should only be done under the immediate supervision of an inspector. In those cases where the lesions are multiple and extensive, and the glands affected, the whole affected fore quarter should be condemned. In the case of the peritoneum, a similar limited localisation should be dealt with by wide removal of that part of the abdominal wall which is affected. In more extended cases, condemnation of the hind quarters is called for. In either of these instances, if there is evidence of extension by the arterial blood stream, as shown by affection of certain lymph glands, the whole carcass should be

condemned. The lungs and associated glands should invariably be condemned if the pleura is affected, and the intestines and mesentery in the case of the peritoneum.

3. *When tuberculous lesions are present in the muscular system or in the lymphatic glands embedded in or between the muscle.* The obvious intention here is to prevent the sale of meat which has been affected by the arterial blood stream. Lesions of the muscular tissue are rare. It is generally assumed that the lymph removes whatever infection may reach the muscle, and that the glands draining these areas will develop the tuberculous lesion. A lesion in the muscular tissue, excluding the rare condition of direct extension from a lesion in some other tissue, indicates infection by the arterial blood supply; and similar significance attaches to lesions of bones, joints, and sexual organs, and also infection of the spleen and kidney.

It would be better definitely to state the glands, the affection of which is regarded as being of sufficient importance to justify condemnation of a whole carcass. The term "embedded" in or between muscles is not precise. It might be argued with some show of reason that some of the cervical, prepectoral, supra-sternal, subdorsal and certain glands of the hind quarter are embedded in muscle, but the significance of their being affected is not so great as to justify total condemnation.

The glands having the importance which is suggested should be limited to those already enumerated (see p. 58).

4. *When tuberculous lesions exist in any part of an emaciated carcass.* This recommendation is obviously sound. Emaciation always calls for condemnation, whatever the disease which gives rise to the emaciation.

No reference is made in the regulations to the requirement of condemnation in cases of associated infection of septic origin. This condition is more generally found in connection with primary lesions, and the chief point for consideration is size, in association with acuteness of symptoms both local and general. In acute cases insufficient

deliminating membrane may exist which allows of extensive absorption. This gives rise to feverish symptoms or those of toxæmia, evidence of which is found in colour and smell and setting of the meat, and possibly in changes in the lymphatic glands. These cases are considered from the ordinary standpoint of septic infection with the additional factor that it is superimposed on a tuberculous lesion.

*The carcass, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized.*

1. *When the lesions are confined to the lungs and lymphatic gland.* No exception can be taken to this recommendation. It is only necessary to remember that when miliary lesions have become associated with the primary lesion condemnation of the whole carcass may become necessary, but this is provided for by a separate recommendation. Certain acute primary lesions and complications, such as large abscesses, may call for condemnation of carcasses.

2. *When the lesions are confined to the liver.* They are practically never confined to the liver,[1] the portal gland is soon affected, and the mesenteric glands are usually infected in cases where the arterial blood supply has not conveyed the infection. In this latter instance the lungs would generally show infection, and thus transfer the case to another group. If the glands, as suggested, are included, the advice would be acceptable.

3. *When the lesions are confined to the pharyngeal gland.* It is not an exceptionally frequent occurrence for bovine animals to show tuberculous lesions alone in these glands, and when affected they are generally evidence of infection by feeding, and in young stock. In these instances condemnation of the parts drained by such glands would meet the case.

4. *When the lesions are confined to any combination of the*

[1] This sentence is qualified because of the possibility of infection reaching the liver by means of a vein in the intestinal mucosa.

*foregoing, but relatively small in amount.* The combinations are as follows :—

(*a*) Tuberculosis of the pharyngeal glands with pulmonary lesions. These latter may be primary or secondary. If primary the recommendation is sound, but if secondary the lung lesions will be of the miliary type, and the case thus transferred to another group for decision. Additional combinations occur later according to the distribution by the arterial system.

(*b*) A primary lesion in the lungs with embolic foci in the liver. In this case the primary lesion in the lungs may be of the chronic type, and the liver lesions single or few, in which case the rule would be sound. On the other hand, the lung lesion may be acute, which would require greater significance to be paid to liver lesions and indicate the necessity for careful decision. If the primary lesion was such as to suggest that escapes of infection into the arterial stream were frequent, condemnation would be necessary.

(*c*) Embolic foci in the liver (regarded as an extension from a primary lesion in the mesenteric glands) with secondary deposits in the lungs. These latter would transfer the example to the miliary group for classification.

(*d*) Lesions in the mesenteric glands and liver, together with lesions in the pharyngeal glands—an unusual combination as a primary condition. If there is extension to the lungs, either from the abdominal or cervical lesions, the classification would again be that of miliary tuberculosis; but with lungs free the recommendation is acceptable, as there would be no evidence of infection having passed the lungs.

## Suggested Course of Action which should be taken in Cases of Bovine Tuberculosis

*Congenital Tuberculosis.*—The carcasses of calves showing congenital lesions should be condemned together with all organs.

NOTE.—Congenital cases may not be recognisable as such if the animals are several months old when slaughtered, owing to the considerable development of secondary lesions, which makes it impossible to decide which are the earliest lesions. The distribution of the lesions in such cases would call for condemnation even if the origin were not congenital.

In early cases of congenital tuberculosis, the lesions in the liver spleen and kidney are easily recognised as being older than those in the lungs, or in the mesenteric glands or in the systemic glands. They are also generally of more than one stage of development, and the pulmonary lesions are always of the secondary and miliary type.

*Acquired Tuberculosis.*—The seat of the original primary lesion or lesions should be ascertained if possible. If this cannot be done, a decision will require to be made based on the distribution of the observed lesions.

1. When the primary lesion is in the lungs, condemn the lungs and the associated lymph glands.

(*a*) If there is extension of the infection to the cervical glands, condemn the head and neck. Examine the pre-pectoral glands and remove them, whether tuberculous or not.

(i) If there has resulted secondary extension to the lungs in the form of miliary tuberculosis, condemn the whole carcass if the deposit is considerable.

If the deposit is of lesser degree, examine the liver, spleen and kidneys and their associated lymph glands, and if recent deposits are noted in any two of these organs or their lymph glands, condemn the carcass.

If deposits exist in only one of these organs, or if in two, they are not of recent development as shown by size and fibrous encapsulation, examine the prescapular, precrural, external inguinal or supramammary and popliteal lymph glands, and if any one or more of these glands is also affected, condemn the whole carcass. Only affected organs and glands need be condemned in other cases.

(*b*) If the primary pulmonary lesion or lesions are of an acute character, as shown by the development of tubercles around the original sites of infection, together with a minimum amount of fibrous tissue, regard the case as equivalent to miliary tuberculosis and deal with the carcass as in 1 (*a*) (i).

(*c*) If the lesions (generally primary) are complicated by septic processes, the effect of this on the meat should be considered, and a more serious view of the condition should be taken than when a septic process exists apart from a tuberculous affection.

2. When the primary lesion exists in the mesenteric glands, condemn the mesentery, and the intestines, and also the liver and portal glands, whether these organs show macroscopic lesions or not.

(*a*) If the disease has extended to the lungs in the form of miliary deposits, deal with the carcass as set out in 1 (*a*) (i). As a measure of additional safety in these cases, regard the liver as having been infected by the arterial blood stream from the lungs if tubercles of two or more different ages exist.

3. In cases of double infection, such as a primary lesion in the lungs, and infection of the mesenteric glands (generally resulting from auto-infection), condemn the lungs and associated glands, the mesentery, and the liver and portal glands.

At a later stage when miliary tubercles in the lungs are in evidence, deal with the carcass as in 2 (*a*).

NOTE.—Owing to the fact that the centres of infection are increased in these cases, miliary deposits are more likely to follow in succession, and therefore it is necessary to ensure that recent deposits are not overlooked. In cases of doubt the decision should be in favour of condemnation.

4. In a case of primary lung infection with secondary extensions to both the cervical and mesenteric glands, deal with the carcass as though three separate foci existed. Condemnation of the whole carcass requires consideration if

the animal is emaciated, or if miliary tubercles have formed in the lung in which connection observe the note in paragraph 3.

5. Inoculation lesions should be regarded as primary lesions until proof of extension by the venous blood stream exists, as shown by miliary deposits in the lung. When this stage is reached deal with the carcass as set out in 1 (*a*) (i).

6. Tuberculous carcasses should be wholly condemned if emaciated, or if the animals are slaughtered whilst in a condition of fever.

7. If tuberculosis of the pleura exists, provided the lesion on the parietal pleura is a single area, of reasonably limited extent, and the subdorsal and supra-sternal glands show no signs of infection, the part of the chest wall bearing the lesion may be removed and the rest of the joint passed for human consumption. It would be an additional precaution to strip the pleura from the rest of the affected chest wall, but this should be done only under the supervision of an inspector. Stripping of the pleura should not be allowed except under supervision. When the lesions are multiple and extensive and the glands are affected, the whole fore-quarter should be condemned. More extensive lesions may be permitted on the visceral than on the parietal pleura without requiring condemnation of the fore-quarter.

8. If tuberculosis of the peritoneum is present, the part of the flank on which it is placed should be cut away and condemned, allowing a fair margin for safety. The abdominal contents should also be condemned. The lumbar glands should be then examined. If these are free from infection, the carcass may then be passed after removal of the affected part; but if they are affected the hind quarter should be condemned.

9. Tuberculosis of both pleura and peritoneum combined should be dealt with as though the lesion on each serous surface were being considered separately. There does not appear to be sufficient reason to condemn the carcass simply because there is slight double infection. Slight lesions in each cavity should be dealt with as in paragraphs 7 and 8.

## CHAPTER IV

# THE TUBERCULOSIS PROBLEM AS AFFECTING PIGS

Variations in incidence and reasons for same—Statistics—Differences between porcine and bovine tuberculosis—Types of bacilli causing pig tuberculosis—Reports by Eastwood and Griffith, and Christiansen—Recommendations of the Royal Commission—Statistics showing degree of infection of carcasses—Disseminated tuberculosis dependent upon the mammalian type of infection—Dissemination without macroscopic pulmonary lesions—Differences in lesions dependent upon type of infecting organism—Suggested course of action in the case of infected carcasses.

### Prevalence of Tuberculosis in Pigs

An accurate comprehension of the frequency of tuberculosis in pigs can hardly be gained from slaughter-house statistics, since variations in the amount of inspection result in pigs in doubtful health being sent to areas where inspection is poorly carried out, and only those supposed to be free from defect being slaughtered where the supervision is most active. Variations may arise in districts which, although widely separated, carry out equal supervision, and these depend upon the existence of local circumstances which pre-dispose to the condition in pigs. For example, pigs from dairying counties, which are fed on milk residuals, will show a greater percentage of tuberculosis than those from districts where dairying is not a feature. For these reasons, the returns of the Board of Agriculture,[1] which refer to investigations conducted in different parts of the country, are particularly

[1] "Annual Report of the Chief Veterinary Officer of the Board of Agriculture for 1914." (Cd. 8043.)

instructive. In the report of the Chief Veterinary Officer for 1914, details are given respecting pigs which were found to be tuberculous at the time of examination, and which were slaughtered as part of the procedure in swine fever investigations. Out of 8,632 pigs of all ages so slaughtered, 989 were found to be tuberculous. This represents a percentage of 11·5, and is undoubtedly a surprisingly high total, but fortunately it cannot be regarded as representing the average. It often happens that an owner possesses a herd which includes many thriftless and ailing animals, and he may consider that the herd is affected with swine fever. He notifies the Board, but investigation with post-mortem examination shows the condition to be tuberculosis. This fact would materially increase the percentage of tuberculous infected pigs among those examined by the Board. On the other hand, the percentage observed in slaughter-houses is probably too low, owing to the animals being selected if they are to be taken to a district to be slaughtered where interest in the work is sufficiently keen to result in statistical tables being prepared. The percentage on the Board's figures amounts to 11, and the average for Birmingham, Glasgow, and Brighton is about 3, the percentage for the country as a whole is therefore below 11 and above 3; probably 5 per cent. would not be far wide of the mark.

It is a matter of additional interest to note that, as in the case of cattle, the risk of infection increases with age, and varies from 3·2 per cent. in unweaned pigs to 19·6 per cent. in mature boars. Doubtless a large proportion of the earlier infection results from maternal transmission, and the later increases follow infection from feeding on tuberculous offal, either of animals or poultry.

The actual figures are as follows :—

| Description. | No. of pigs examined. | Number affected. | Percentage affected. |
|---|---|---|---|
| Unweaned .. .. | 1,395 | 47 | 3·2 |
| Fatting .. .. .. | 1,841 | 178 | 8·8 |
| Stores .. .. .. | 4,401 | 594 | 11·9 |
| Sows .. .. .. | 913 | 150 | 14·1 |
| Boars .. .. .. | 92 | 20 | 19·6 |

As stated the percentage of infection is much higher than that reported from either English or foreign slaughter-houses, a series of which is shown in the following table :—

| District. | Date of information. | Percentage affected with tuberculosis. | Authority. |
|---|---|---|---|
| Brighton .. | 1914 | 2·73 | Eastwood & Griffiths. |
| Birmingham .. | 1914 | 2·7 | Veterinary Inspector. |
| Glasgow .. | 1914 | 5·6 | ,, ,, |
| Versailles [1] .. | 1913 | 0·4 | P. Chaussé. |
| Brussels [1] .. | 1912 | 0·28 | Veterinary Fally. |
| Luxembourg [1] .. | 1912 | 0·97 | ,, Spartz. |
| Copenhagen [1] .. | 1911 | 4·69 | ,, Rasmuessen. |
| Denmark [2] .. | 1911 | 4·48 | |
| Buda-Pesth [1] .. | 1912 | 1·63 | ,, Brenn. |
| Norvare [1] (Italy) | 1911 | 1·0 | ,, Genotte. |

Of 368,428 Dutch pigs slaughtered for export to London, 5,516, or 1·5 per cent., were found to be tuberculous.

The variations shown in the different districts and countries are the result of several factors, not the least important being the manner of feeding already referred to. It will be noted that in Copenhagen and in Denmark as a whole, where there is considerable dairying work, there are higher rates than in other districts. Mohler and Washburn [3] have also drawn attention to the same fact. They report that of 325,000 pigs slaughtered in Fort Worth, Texas, where the animals are raised on alfalfa supplemented with grain, only 51 or 0·016 per cent. were condemned as unfit for food, as compared with 3·1 per cent., 3·4 per cent., and 6·4 per cent. respectively, condemned in the same period in three cities in one of the leading dairying States.

## Differences between Bovine and Porcine Tuberculosis

There are several important points of difference in the behaviour of tuberculous infection in the pig and the ox.

[1] "La Tuberculose du Porc," par P. Chaussé.

[2] "Hygiene de la Viande et du Lait," 1913.

[3] "Tuberculosis of Hogs," by J. R. Mohler and H. J. Washburn. United States Department of Agriculture.

Primary inhalation tuberculosis is the more common method of infection in the ox, intestinal lesions in the form of tuberculosis of the mesentery or cervical glands being often the result of auto-infection or of dissemination. Primary intestinal infection is uncommon apart from the congenital cases, and the few cases in calves which follow the ingestion of infected food. On the contrary, the intestinal type is the common affection of pigs sent for slaughter to furnish human food. For this purpose they are mostly slaughtered when less than eight months old. The different habits of the two animals account partly for the different modes of infection. The calf is a vegetable feeder when it leaves its mother, but pigs feed on animal matter from an early age.

The weak spots in the digestive tract are asserted by Chaussé[1] to be the tonsils in the upper part, and Peyer's patches and the solitary glands in the intestines. The latter are histologically comparable with the former. He assumes that traumatism plays a considerable part in producing the lesion. Whether this be so or not, it is the fact that lesions are fairly frequently found in the tonsils, though I have not observed the same in the intestinal glands. It is by no means a regular occurrence to find the tonsils showing abnormality even when the submaxillary glands are the seat of disease.

Pigs, also, are much more susceptible to infection by the tubercle bacillus than are other food animals. The bovine, human, and avian types of bacilli all produce lesions in the pig, and although there is apparently a different intensity or virulence dependent upon the type of attacking organism, it is not possible to be certain from macroscopic appearances which type is present in any particular case.

The infection in the pig is more progressive than in bovines. In the latter, retrogressive changes and chronicity are features, but in the pig the disease progresses more

[1] "La tuberculose du porc, epidémiologie, pathogénie et évolution comparee," par P. Chaussé. Annales de l'Institut Pasteur. LXXIX Mes. 11–12. (Nov., Dec., 1915.)

rapidly and fibroid changes are not so frequently met with, dissemination being the rule rather than the exception, and that within a few months of infection. The dissemination also appears to be more extensive, since the liver and spleen frequently show many more lesions than is the case in bovines, and also at an earlier date, when compared with the characteristics of the primary lesion in each.

This increased susceptibility and the greater power of extension by the blood stream probably also account for the greater frequency of infection of the systemic lymphatic glands and of lesions in the bony skeleton which are met with as compared with corresponding conditions in bovines.

## Types of Tubercle Bacilli observed in Pig Tuberculosis

Various observers have investigated the type of the bacillus which gives rise to tuberculosis in pigs since the Royal Commission directed attention to the fact that tuberculosis in the pig might be due to bacilli of the bovine, avian, or human type, and 59 cases were examined with the following result.

| egree of tuberculosis in the pig. | Bovine virus. | Human virus. | Avian virus. | Mixed avian and bovine. | Total. |
|---|---|---|---|---|---|
| Local tuberculosis .. .. | 18 | 3 | 5 | — | 26 |
| Generalised .. .. .. | 32 | — | — | 1 | 33 |
| Total .. .. | 50 | 3 | 5 | 1 | 59 |

Eastwood and Griffith [1] obtained tubercle bacilli in culture from 78 pigs, and of these 26 were of the avian, 47 of the bovine, and 1 of the human type. There was one instance of mixed avian and bovine, and one of mixed bovine and human, whilst in two instances atypical types were

[1] "A Report on Localised Tuberculosis in Swine," by A. Eastwood, M.D., and F. Griffith, M.B. (Reports of the Local Government Board. New Series, No. 91.)

recognised. It follows that in the Royal Commission cases of pig tuberculosis 5 out of 59, or 8·5 per cent., were due to avian tuberculosis, and in Eastwood and Griffith's cases 26 out of 78, or 33 per cent.

As bearing on these figures it is interesting to note that the Commission state, "in the guinea pig the avian bacillus does not induce progressive tuberculosis, and the lesions produced may be minimal," and further, "in our experience the bovine bacillus only has been found to be the cause of natural generalised tuberculosis in the pig." Another conclusion arrived at was to the effect that "a mixed infection with human and bovine tubercle bacilli must be considered possible in the pig, although it was not found in any of the cases investigated by us." Eastwood and Griffith discovered one such case.

Christiansen,[1] whose results will be referred to later, examined 118 tuberculous pigs and determined the type of bacillus in 114 cases. Of these he found the disease was due to the avian type in 86 instances (75·5 per cent.), and to the bovine in 28 (24·5 per cent.). These totals show a much higher percentage of avian infection than in those already mentioned, and probably local circumstances relating to the manner of feeding or the prevalence of fowl tuberculosis might account for it.[2]

## Inspection of Pig Carcasses

The recommendation of the Royal Commission in cases of pig tuberculosis is to the following effect :—

"In view of the greater tendency to generalisation of tuberculosis in the pig, we consider that the presence of

[1] Extract. "Hygiene de la Viande et du Lait," July, 1914. No. 7, p. 351.

[2] It should be remembered that the cases examined both by the Royal Commission and by Eastwood and Griffith were selected cases. In the former group attention was directed mainly to slight cases of tuberculosis, and in the latter, the investigation related to tuberculous lesions macroscopically limited to the primary seats of infection.

tubercular deposit in any degree should involve seizure of the whole carcass and of the organs."

This is an extremely sweeping recommendation, and remembering the considerable prevalence of tuberculosis in the pig, it demands the fullest justification if it is to be literally observed. I have failed to discover in the report of the Royal Commission any evidence in support of the recommendation. A decision as to whether such a high standard is really necessary may best be arrived at by studying the location of the disease in pigs.

Christiansen, as already stated, examined 118 pigs, and ascertained the type of bacillus present in the lesion; he also classified the lesions as follows :—

| Tuberculous lesions. | Type of bacillus present. | | | |
|---|---|---|---|---|
| | No. of pigs examined. | Avian. | Bovine. | Undetermined. |
| Localised to the mesenteric lymphatic glands .. .. | 61 | 58 | 1 | 2 |
| Localised to the cervical glands | 15 | 7 | 7 | 1 |
| Affecting both mesenteric and cervical glands .. .. .. | 9 | 9 | — | — |
| Affecting the lymph glands generally, and the viscera .. .. | 33 | 12 | 20 | 1 |
| Total .. .. .. | 118 | 86 | 28 | 4 |

It will be observed that in the avian type of infection there is a great tendency to infection of the mesenteric glands, and that there is a greater frequency of generalisation in the bovine type, 20 out of 28 cases, than in the avian, 12 in 86 instances. The tabulation as given would appear to suggest that of the 118 cases it would only have been justified to condemn the whole carcass in 33.

As regards English experience, the cases investigated by Eastwood and Griffith may be used, as these workers give sufficient information to allow of conclusions being drawn, from the meat inspection point of view. This work was conducted mainly from the pathological standpoint, but

I have permission to use their records in the manner suggested.

In the following table the cases are arranged according to the location of the primary lesion, and the numbers in the last column refer to the case numbers in the original work.

CLASSIFICATION OF EASTWOOD AND GRIFFITH'S CASES.

| Group. | | Type of bacillus. | | Reference number. M = Mammalian. A = Avian. |
|---|---|---|---|---|
| | | Mammalian. | Avian. | |
| Strictly localised cases | Submaxillary glands .. | 11 | 10 | M. 14–70, 71, 75, 76, 77, 79, 82, 86, 88, 95 A. 31, 38, 39, 44, 67, 68, 72, 89, 92, 97. |
| | Mesenteric glands .. | — | — | |
| | Double infection of submaxillary and mesenteric glands. | 2 | 2 | A. 61, 69. M. 30, 74. |
| Extension from the primary lesion to adjacent organ or its gland. | Submaxillary gland to lungs or bronchial gland, or both. | 5 | 2 | M. 19, 55, 73, 84, 99. A. 10, 15. |
| | Mesenteric gland with extension to the liver and portal gland. | — | 3 | A. 9, 17, 18. |
| Extension in cases of apparent double primary infection of cervicals and mesenteric glands to adjacent organs. | Deposits in liver only .. | — | 1 | A. 78. |
| | ,, ,, lungs only | 2 | — | M. 46, 47.[1] |
| | ,, ,, both liver and lungs | 2 | 2 | M. 48, 94. A. 50, 53.[2] |
| Infection of mesenteric gland with extension to liver and later to lungs. | | — | 1 | A. 23. |
| | Totals .. .. | 22 | 21 | |

[1] In case 47 the submaxillary gland was tuberculous and possibly one mesenteric gland. The lungs showed lesions but not the bronchial glands. The liver was normal, though there were two or three caseous foci in the portal gland. The case is regarded as one of double primary infection with extension to the lungs from the cervical glands.

[2] In case 53 infection in the lungs was demonstrated by inoculation of apparently healthy tissue. There were no macroscopic lesions

Of the above cases 22 were instances of infection by the mammalian type of bacillus and 21 by the avian. There is no suggestion of special incidence of infection of the mesenteric glands. All are instances either of strict localisation, or of extension only by way of the venous blood stream, the possible exceptions to the latter being cases 48, 94, 50, and 53. In these it is not possible to state definitely whether the liver was infected by way of the portal vein, or the hepatic artery. It was probably the former, as no other lesions were discovered, and the spleen and inguinal glands (the only systemic glands examined) were free.

All these carcasses might safely have been passed for human consumption after condemnation of the head and neck, and internal organs.

In these cases there does not appear to be much difference in distribution between those due to the mammalian type of organism and those in which the avian bacillus was found, but in considering more extensive dissemination in which the arterial blood stream appears certainly to have conveyed the infection the differences are more pronounced. A definite conclusion that the arterial blood stream has been the means of conveyance is assumed when the liver is infected without associated lesions in the mesenteric glands, and also where the spleen is affected, whether in association with hepatic lesions or not.

The following tabulation shows the location of the lesions in cases of arterial dissemination. The first series consists of cases in which the primary lesion was in the submaxillary glands, and the second in which there were probably two seats of primary infection, viz. mesenteric glands as well as submaxillary ; the single case in the third group (No. 25) showed no lesion in the cervical gland, and the mesenteric gland was not examined. It is possible that the primary deposit was in these latter glands and dissemination followed the usual course.

It will be observed that the liver was affected in association with a primary lesion of the submaxillary gland, but

INSTANCES OF DISSEMINATED INFECTION.

| Case No. | Sub-maxillary gland. | Lungs. | Bronchial gland. | Mesenteric gland. | Liver. | Portal gland. | Spleen. | Inguinal. |
|---|---|---|---|---|---|---|---|---|
| 33 | + | + | + | − | + | + | + | − |
| 36 | + | + | + | − | + | + | + | − |
| 42 | + | + | + | − | + | ? | + | ? |
| 43 | + | + | + | − | + | + | + | − |
| 49 | + | + | + | − | + | + | + | − |
| 54 | + | + | + | − | + | ? | + | − |
| 65 | + | + | + | − | + | + | + | − |
| 83 | + | + | + | − | + | − | + | − |
| 85 | + | + | + | − | + | + | + | − |
| 41 | + | + | + | − | + | − | − | − |
| 45 | + | + | + | − | + | + | − | − |
| 93 | + | + | + | − | + | − | − | − |
| 59 | + | + | − | − | + | + | + | − |
| 24 | + | + | + | + | + | ? | + | ? |
| 51 | + | + | + | + | + | + | + | − |
| 63 | + | + | + | + | + | + | + | ? |
| 90 | + | + | + | + | + | + | + | − |
| 98 | + | + | + | + | + | + | + | − |
| 25 | − | + | + | ? | + | + | + | + |

without splenic lesions in three instances, and with lesions of the spleen in 10. In the five cases of double primary infection the spleen contained tuberculous lesions in all. The spleen and inguinal glands were affected in case 25.

All the above were instances of infection with the bovine bacillus, and in all there were lesions in the lung. No instance of this combination resulting from avian infection was observed. This is interesting, and it is important to note that in both avian and bovine infections dissemination by the arterial stream would seem to be frequently possible without lesions showing in the lung. It does not seem possible to account for the disposition of certain lesions except on this hypothesis, and I have frequently seen instances in which the most careful examination of the lung has failed to indicate the presence of lesions when they have been observed in the liver, the mesenteric glands being free, or if the latter were affected, then in the spleen. Unless such a possibility is granted, it would require the

suggestion of backward flow to the splenic gland, and thence into the parenchyma of the organ to account for it.

The grouping of these cases is set out below.

INSTANCES OF DISSEMINATION BY THE ARTERIAL BLOOD STREAM WITHOUT MACROSCOPIC EVIDENCE OF DISEASE IN THE LUNGS.

| | Submaxillary gland. | Lungs. | Bronchial gland. | Mesenteric gland. | Liver. | Portal gland. | Spleen. | Inguinal. | Observations. |
|---|---|---|---|---|---|---|---|---|---|
| *Avian.* | | | | | | | | | |
| 29 | + | — | — | Not examined. | + | + | — | — | Inoculation of liver and *spleen* tissue proved the presence of tubercle bacilli in these organs. |
| 52 | + | — | — | + | ? | — | — | — | Ditto. ditto. |
| 58 | + | — | — | — | — | — | — | — | Ditto. ditto. |
| 60 | + | — | — | — | ? | — | — | — | *Spleen* tissue gave a positive result, but liver tissue negative. |
| 64 | + | — | — | — | — | — | — | — | Tubercle bacilli demonstrated in *muscular tissue.* |
| 66 | + | — | — | — | ? | — | — | — | Tubercle bacilli demonstrated in the *liver.* |
| *Mammalian type.* | | | | | | | | | |
| 35 | + | — | — | + | — | Not examined. | + | — | Culture obtained from a lesion in the *spleen;* there was only one nodule. |
| 62 | + | — | + | + | + | + | — | — | Apparently infection passed through lungs to *bronchial gland.* |
| 81 | + | — | — | + | — | — | + | — | The *spleen* showed one tubercle under the capsule and one in the substance of the organ. |
| 91 | + | — | — | — | — | — | — | — | Tubercle bacilli demonstrated in *liver* substance. |
| *Mammalian* | | | | | | | | | |
| 99 | + | — | + | — | ? | — | — | — | The infection of the bronchial gland suggests infection by way of the lungs. |

In the above cases the chief interest lies in the fact that the organisms were discovered in situations which would indicate that they must have passed through the lungs to reach the locality where they were found, and in doing so had

failed to give rise to recognisable lesions in the lungs. There seems a greater possibility of the avian type getting free without giving rise to pathological changes, than of the mammalian; for it will be seen that in the avian infections the organism was discovered in four instances in the spleen, which showed no macroscopic lesion, whereas in the mammalian cases lesions were observed in the two spleens in which bacilli were demonstrated in apparently normal tissue. Possibly the greater virulence of the mammalian type gives rise to an earlier reaction of the tissues, which would tend to enclose the primary focus, whilst the tissue being more tolerant of the avian, escape is more easy and frequent. In any event the frequency of bacilli in organs apart from recognisable lesions would indicate that in tuberculous infection of any degree in the pig the internal organs should be condemned.

In the case of pigs in which infection resulted from intentional feeding on infected material, the same results were observed. Several of the infected animals might with safety have been passed for human food, and in certain organs bacilli were found apart from recognisable lesions. The following summary gives the situation of the lesions in animals purposely infected.

LOCATION OF LESIONS IN PIGS FOUND TO BE TUBERCULOUS AFTER FEEDING ON INFECTED MATERIAL.

| Case. | Sub-maxillary gland. | Lungs. | Bronchial gland. | Mesenteric gland. | Liver. | Portal gland. | Spleen. | Other organs. |
|---|---|---|---|---|---|---|---|---|
| 4 | + | + | − | − | − | − | − | − |
| 5 | + | − | − | + | − | − | − | − |
| 10 | − | − | − | + | + | + | − | − |
| 17 | − | − | − | + | + | + | − | − |
| 6 | − | + | − | + | + | + | − | − |
| 9 | + | + | + | + | + | + | − | − |
| 11 | − | + | + | + | + | + | − | kidney |
| 12 | + | + | + | + | + | + | + | − |
| 13 | + | + | − | + | + | − | − | − |
| 14 | + | − | − | + | + | − | − | − |

Of the above, cases 4, 5, 10, and 17 might certainly have been passed for human consumption. Cases 6 and 9 would have been passed assuming the systemic glands had been free from infection and the lesions in the lungs slight. Case 11 shows more pronounced dissemination from infection of the kidney, and case 12 from infection of the spleen. In cases 13 and 14 the pigs were fed with the human type of bacillus, and again these would have been passed, assuming the systemic glands had been free and in the case of 13, the lungs slightly affected. In no instance would an infected animal have been passed without condemnation of the internal organs, and without the vertebral column having been split open and examined, and the affected heads and necks removed and condemned.

In these animals the presence of tubercle bacilli was demonstrated in apparently healthy organs in two out of three lungs, and one out of 9 submaxillary glands examined. In the case of apparently healthy tissue from organs showing lesions of tuberculosis, bacilli were demonstrated in one only out of three examinations of lung tissue, but in three out of four examinations of liver tissue.

Negative results followed the examination of apparently healthy bronchial gland (1 case), mesenteric glands (2 cases), liver (2 cases), and spleen (6 cases). Apparently normal tissue taken from organs showing lesions gave a negative result in one case each of submaxillary gland and mesenteric gland.

## Differences between Avian and Bovine Lesions in the Pig

The slight pathogenicity of the avian bacillus for man would appear to suggest that if any striking characteristics existed between the types of lesions produced by the avian and bovine bacilli respectively, which admitted of recognition by a meat inspector, a differential treatment of affected carcasses might be desirable. Eastwood and Griffith consider this point, and state that " When the infection was due to

the typical bovine bacillus, the glands were commonly enlarged, often to a marked extent, and frequently the adjacent glands had become fused into a coherent mass. On section the gland substance was often found to be partly or completely replaced by fibro-caseous, gritty material embedded in a firm, translucent matrix. When the infection was due to the avian bacillus, the glands were often not enlarged, and when enlargement was present, it was usually slight or only moderate in amount. On section, the glands were found to contain a varying number of caseous and gritty or calcareous nodules, which were easily shelled out of the surrounding gland tissue and left behind smooth, fibrous-walled cavities. But there were several instances where the macroscopic appearances failed to give correct indication of the type of bacillus causing the infection."

In these circumstances it is therefore obvious that reliable differentiation is not possible, and that tuberculous lesions in the pig must all be regarded from a standpoint which ignores the type of the infecting organism, and therefore any regulations which may be framed should have the object of safeguarding the consumer against the type showing the greatest pathogenicity.

## Action advised in the Case of Pig Tuberculosis

In general there does not seem to be sufficient reason why the general principles regulating the inspection of bovine carcasses should not be applied to the inspection of pig carcasses, provided due weight is paid to the special points of difference which are known to exist; these are as follows:—

1. Primary infection of the lungs in pigs is met with only infrequently in slaughter-houses. Lesions in the lung are therefore nearly always of the embolic type. Primary infection of the digestive tract, on the other hand, is the common form.

2. The ratio of cases showing lesions carried by the blood stream is higher in pigs than in cattle, and therefore total condemnation must of necessity be more frequent.

3. The lungs frequently fail to show lesions when these are present in other organs, so that absence of macroscopic lesions in the lungs does not justify the assumption that there has been no arterial dissemination.

4. Tuberculous lesions of bones and joints are more frequent in the pig than in the ox.

5. Dissemination follows with fair rapidity, and the disease is generally progressive in pigs. On this account and for reasons above mentioned, tuberculosis in the pig in even slight amount in the cervical or mesenteric glands requires as a routine (*a*) the examination of all organs; (*b*) the examination of bones and joints, particularly the cervical column by splitting down, and the ribs for nodules, as well as a careful inspection of the hock joints, opening these up if necessary; and (*c*) an examination of the prescapular, precrural, and supra-mammary glands. Any evidence of deposit in situations (*b*) and (*c*) calls for condemnation of the whole carcass.

6. The pig is prone to attack by any of the three recognisable types of tubercle bacilli. In numerous instances the internal organs contain living bacilli without macroscopic evidence of the disease. The liver, lungs and spleen of a tuberculous pig should always, therefore, be condemned.

(This recommendation may be criticised from the point of view that if bacilli rest in the organs they may likewise do so in the tissues, and therefore if it is necessary to condemn organs it should also be necessary to condemn the carcass. The reasons against this are that the organisms which do not give rise to lesions are mostly of the avian type, the mammalian type is usually associated with macroscopic lesions. The bacilli seem able to reside in organs for a longer period than in the muscular system; in the latter case they soon appear to pass into the lymphatic glands and either set up lesions or are destroyed.)

7. Pigs are often submitted for sale in wholesale markets with the heads and necks or lymphatic glands removed and unaccompanied by the organs. Power should be given to condemn these carcasses, as removals of this kind are generally on account of tuberculous infection, and it is essential that the character of the lesion should be examined in certain instances.

8. Tuberculosis of the pleura and peritoneum is not so common in the pig as in the ox, and when it does exist, it is usually a manifestation of more advanced disease in the former than in the latter, and much more frequently calls for total condemnation.

## CHAPTER V

## IMPORTED MEAT

Imported meat—Historical facts—Statistics—Foreign Meat Regulations, 1907—Boneless and canned meat—Frozen and chilled meat—Physical changes observed in frozen meat—The process of defrosting—The regulation of cold stores—The inspection of imported carcass meat—Bone-taint—Orange-coloured streaks in fat—Diseases in imported carcasses: Onchocerciasis, Actinomycosis, Hæmorrhages into the muscles, Foot and mouth disease—The handling of meat.

The annual amount of flesh meat consumed per head of the population was about 131 lbs. in pre-war times; of this, 59 per cent. was home-killed, and 41 per cent. imported. The division of 126 lbs. of this total shows that in the case of beef and veal 40·3 lbs. was home-killed, and 23·3 lbs. imported; in the case of mutton and lamb the respective figures were 15·7 and 12·7 lbs., and for pork and pig products 19·9 and 14·0 lbs. A comparison of the figures of the last ten years shows a tendency to increased consumption of mutton and lamb in which the increase is mainly noted in the imported variety, and a definite reduction in the consumption of the flesh of the pig: the figures[1] for 1900–3 showing a total consumption of 42·5 lbs. per head against 33·9 lbs. in 1912–13. The greater portion of this reduction was in the imported variety, the amount of which in the years stated declined from 21·5 lbs. to 14·0 lbs.

The increased consumption of imported meat has been in progress for many years, but the character of the supply has undergone a change. Prior to 1892, continental countries,

[1] Report of Board of Agriculture and Fisheries, Vol. XLVIII., Part IV. (Cd. 7551).

chiefly Holland, Denmark, and Germany, exported largely both live cattle and sheep, and cattle were received from the United States in considerable numbers. The year of maximum importations was 1890, when 642,747 live cattle and 1,065,470 live sheep were imported. This is in marked contrast with the year 1913, when only 12,000 cattle and less than 1000 live sheep entered this country.

This decrease has resulted from orders prohibiting the importation of live animals for preventive reasons. Importations from the continent were forbidden in 1882, but for some time after this, cattle were permitted to be landed for slaughter from the United States, Canada, and the Argentine. In 1900 the ports were closed to Argentine cattle, and to-day the landing of live cattle is regulated by the Foreign Animals Order of 1910, by which the landing of live animals is prohibited from the Argentine, Austria, Belgium, Bolivia, Brazil, Cape Colony, Chili, Columbia, Denmark, Ecuador, France, Germany, Gibraltar, Greece, British, Dutch and French Guiana, Italy, Malta and Mexico, Natal, Paraquay, Portugal, Russia, Sweden, Uruguay and Venezuela. The landing of swine is also prohibited from the United States. Animals from countries not on the prohibited list may only be landed at Liverpool (Birkenhead), London (Deptford), Glasgow (Marklands), Bristol (Avonmouth), Cardiff (Bute Docks), and Manchester (Old Trafford).

In the United Kingdom the population during the decennium 1901–11 increased at a greater rate proportionately than did the numbers of cattle and sheep, but in the case of pigs the position was the reverse. This fact, in association with the prohibitions mentioned, might have been serious had no other way of supplementing the supplies than by means of live animals been available. Discoveries, however, in connection with the practical application of refrigeration to the meat industry proved the saving factor.

In 1861 [1] freezing works had been established at Sydney,

[1] "A History of the Frozen Meat Trade," by J. T. Critchett and J. Raymond, 1912.

New South Wales, and at a luncheon on September 2, 1875, the guests were served with meat which had been kept from the June of the previous year. In 1876 the *Northam*, a sailing ship fitted with freezing plant, attempted a trial shipment of frozen meat to England. The venture was a failure, as the ship never started on the voyage, owing to mechanical difficulties arising. T. C. Eastman shipped the first consignment of chilled American beef to London, 1875, but various subsequent attempts to transport meat from Australia to London resulted in total failure or only partial success. The *Paraquay* successfully carried 80 tons of mutton from South America to Havre in 1878, and the s.s. *Strathleven* successfully carried 40 tons of beef and mutton from Australia to London in 1879. Since then progress has been rapid.

A summary table will indicate the amount of meat received from the chief exporting countries engaged in the trade. The figures given represent thousands of cwts.

| Year. | North America. | South America. | Australasia. | Europe. | Other countries. | Total. |
|---|---|---|---|---|---|---|
| 1901 .. | 14,517 | 2,171 | 2,661 | 2,470 | 0 | 21,819 |
| 1906 .. | 12,224 | 4,511 | 2,782 | 2,621 | 0 | 22,138 |
| 1911 .. | 5,274 | 8,913 | 4,688 | 3,476 | 24 | 22,375 |
| 1913 .. | 3,283 | 9,640 | 5,933 | 3,965 | 10 | 22,831 |

Some idea of the actual class of meat imported, and the different classes of trade carried on by the various countries, will best be seen from facts arranged in tabular form. In this table the totals are given in cwts., and the information is obtained from official sources.

It is obvious that a trade in food intended for human consumption of such magnitude, and presenting features distinct from the trade in home-killed meat, requires special administrative measures to control it. The special features include the results of conveyance over long distances; the influence of diseases peculiar to the country of origin; the

AMOUNTS OF VARIOUS CLASSES OF MEAT IMPORTED FROM DIFFERENT COUNTRIES (1913).

*The totals represents cwts.*

| Exporting country. | Beef. | | Mutton. | Pork. | | Hams. | Bacon. | Rabbits. | Preserved otherwise than by salting. | Unenumerated. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh or refrigerated. | Salted. | | Fresh or refrigerated. | Salted. | | | | | |
| Australia .. .. | 1,311,843 | — | 1,661,763 | 372 | — | — | — | 405,223 | 299,558 | 60,717 |
| New Zealand .. | 244,062 | — | 2,198,674 | 2,253 | — | — | — | 61,822 | 19,794 | 17,849 |
| U.S.A. .. .. | 932 | 35,609 | — | 12,014 | 36,896 | 732,961 | 1,742,689 | — | 87,802 | 82,128 |
| Argentina .. .. | 6,966,696 | — | 1,405,632 | — | — | — | — | — | 154,710 | 313,747 |
| Netherlands .. | 1,951 | — | 123,048 | 464,204 | — | — | 185,215 | 11,636 | 4,562 | 208,932 |

utilisation of scraps of meat and the exportation of small unrecognised portions which cannot be submitted to satisfactory examination in this country; the exportation of meat from which the bones have been dissected to save cost of freight; the exportation of edible offal, and the character of meat which is canned or preserved in some other way before export.

Exporting countries, generally, have recognised the necessity for supervising the meat before export, to effect which they have instituted State inspections carried out by State-appointed officials.

In this country the Foreign Meat Regulations were framed and put into operation on January 1, 1909. Under these regulations foreign meat is classified into four groups. Class 1, includes (*a*) fresh, frozen or preserved meat which cannot be identified with parts of a carcass, an exception being made in the case of meat made up into sausages or some other recognised food product; (*b*) tripe, tongue, and kidneys contained in certain specified preservatives; (*c*) severed parts of a pig, not bacon or ham, if not accompanied by an official certificate (this certificate has already been referred to); (*d*) severed parts of a pig in the form of bacon or ham if the lymphatic glands have been removed, and if not accompanied by an official certificate; (*e*) meat whether from cattle or pigs if it includes the ribs from which the pleura has been removed. Class 2 includes only the entire carcass of a pig imported without the head in the natural state of attachment, or from which the lymphatic glands have been removed. Class 3 includes meat in the form of severed parts of the carcass of a pig or other edible parts which does not comprise meat of Classes 1 or 2, and which is accompanied by an official certificate. "Unclassed meat" is any other foreign meat not included in Classes 1, 2, or 3. Of the above groups the meat included in Classes 1 and 2 is not allowed to be discharged for sale in this country; meat of Class 3 is approved, subject to being satisfactory on general grounds;

whilst "unclassed meat" is received and submitted to the ordinary routine of inspection.

Definite reference in these regulations is therefore made to scrap meat and unrecognisable cuts, certain edible offal, pig carcasses, and forequarter meat stripped of the pleural lining. The latter requires no further reference beyond stating that stripping of the pleura often means the removal of evidence of tuberculosis. The references to the pig merely ensure that the carcass shall have been examined prior to exportation, and certified to be fit for human consumption in cases where the whole carcass is not available for examination in this country, and the prohibition of removal of head or glands prevents evidence of disease being removed before exportation. In the case of scrap and boneless meat a few additional observations are necessary.

## Boneless and Canned Meat

The least satisfactory part of the inspection of imported meat, *i.e.* satisfactory to the home inspector, is that relating to boneless meat and canned meat. Scrap meat and trimmings, which are now rightly excluded from importation, were formerly received in barrels or bags, and included neck meat and rib meat cut into small pieces. Boneless meat does not necessarily come within the category of scrap meat, for so long as it can be referred to a definite part of the carcass it is grouped as "unclassed meat." Ready and certain recognition of a joint has an important bearing on inspection, for unless an inspector can with certainty refer a piece of meat to a definite part of the carcass, he is handicapped in his decision as to the matters to which his attention should be directed. He must have a mental image of the characteristics of normal meat from that area, remember the glands to be searched for, and know whether it is a piece which carries a serous membrane. This boned meat should therefore be cut in sufficiently large pieces to show definite anatomical relationship; there must be as little

mutilation as possible in removing the bones; serous membranes must not be removed, and the glands of the part left *in situ*, and if possible so positioned that they may be readily found. Attention must be paid also to the packing. The pieces must be packed so as to retain as far as possible their normal shape without folding or rolling, and each piece should be frozen separately.

Granted that all these requirements are complied with, the position still remains unsatisfactory, and the fullest confidence requires to be placed in unknown inspectors. Meat so forwarded is generally from poor quality animals, no offal is available to assist the inspector, the general appearance presented by the carcass as a whole is lacking, and much has to be taken on trust. The majority of pieces are examined in the frozen state, as only a few may be thawed owing to the deterioration which follows the process even if re-frozen. A somewhat similar position confronts the inspector when examining tins of canned meat. Little more can be done than ascertain that the contents are sterile. Diseased conditions have occasionally been found by careful search of canned meat, but in general, inspection for this purpose is not practicable. It is also more probable that a "plainer" class of meat and perhaps scraps, the importation of which is prohibited in the fresh state, are used for canning.

For these reasons, and also to assist in other branches of the inspection of foreign meat, such as the oversight of the sanitary condition under which the different processes are conducted, and to ensure that the regulations are observed, I consider that the Government should appoint expert inspectors to make periodical visits to the foreign abattoirs and food preparation places from which food products are exported to this country, with the object of noting the conditions under which the work is carried out. It is stated in the last report of the chief Inspector of Foods to the Local Government Board that two inspectors of the Board have been lent to the Army to supervise the foreign canned meat

supplied to the Forces. A similar safeguard should be continued after the war in the interests of the civilian population.

## General Observations relating to Imported Carcass Meat

Carcasses arrive in this country either in the frozen or chilled state. Frozen meat has been submitted to a continuous temperature of about 15° F., and is therefore frozen solid. Chilled meat has been exposed to a temperature only one or two degrees below freezing point, and is therefore ready for sale immediately after it is removed from the chilled room. It is not necessary to-day to justify the statement that both chilled and frozen meat constitute a satisfactory article of diet which is but little, if any, inferior to the home-killed variety either in the relative amount of nourishment, or in digestibility. It is possibly somewhat more digestible than the recently slaughtered home variety, since it has been satisfactorily proved that the maturation or ripening process slowly operates whilst the carcass is in the chilled condition and perhaps even whilst in the frozen.[1] The chief differences between home-killed and imported meat are due to physical changes, the result of the process to which the meat is subjected. Apart from the details of dressing the carcass, chilled meat may differ very little from that of home-killed. It is more readily distinguished from frozen meat, but this distinction becomes progressively less marked if the temperature to which it has been exposed has been lower than 29° F. The fat of chilled meat often assumes a pinkish hue owing to staining with the meat juices, which compares with the yellowish white colour of the fat of home-killed carcasses. There is also some roughening of the tissues due to the friction of transportation. The bundles of meat fibre assume a dull slate colour and on

[1] M. Muller, "Zeitschrift fur Fleisch und Milch Hygiene, 1903–4," p. 217.

section the meat shows some excess of moisture which is most apparent on pressure. These are really refinements of distinction, and it requires a very skilled person to state with certainty in some cases that a small joint is from a chilled carcass and not from a home-killed animal.

Frozen meat is more readily recognised. The carcass presents an unfinished appearance, the fat is dead white in colour, rigid, and in varying degree rough and ragged. Unless previously thawed, the outside of the carcass will be found covered with moisture condensed from the atmosphere. On section the muscular tissue will be found uniformly light in colour, which gives it a washed-out appearance. It is moister than either home-killed or chilled meat, and the extent of this exudation will depend upon the care displayed in thawing. The exposed surfaces of the sawn bones are white in frozen meat, whereas in chilled, if from young good quality animals they may retain the rose-tinted appearance of home-killed animals.

The chief objections to these refrigerated carcasses are that the moist condition of the flesh, and the previous process of maturation which they have undergone render them liable to putrefactive changes sooner than home-killed carcasses, and, in the case of frozen meat, that the thawing process, unless satisfactorily performed, results in the loss of much of the valuable meat juices.

The first of these objections is countered by ordinary methods of administration. The wholesale butcher keeps his supply in cold stores until he requires it for transmission to the retailer, and the retailer simply buys what he knows he can sell in the period during which the meat keeps in satisfactory condition, or he may have a refrigerating chamber in which he keeps his stock, only bringing out his supply for sale as he requires it.

The loss of meat juices from frozen meat is of greater importance, but a knowledge of the circumstances which cause it will undoubtedly lessen the risk. It has been stated that in the process of freezing, the muscle fibres are

lacerated by the ice spicules which form, and that on thawing, the moisture which exudes is due to the escape of the liquid contents of the muscle fibres. This, however, does not appear to be the case. Richardson [1] has satisfactorily shown that the water freezes outside the cell and not inside. The ice thus formed occupies as much or more space than did the muscle fibres, and these as a consequence of the freezing process become isolated and distorted. If meat in this condition be quickly thawed, the fibres are not able to reabsorb the liquid as quickly as it reassumes the fluid state, and therefore it exudes from any cut surface. On the other hand, if the thawing is done slowly, a considerable amount of the juice is reabsorbed, and the extent of the moisture observed on the cut surface of a thawed joint depends upon the completeness or otherwise of this reabsorption. The rapidity of reabsorption depends to some extent on the temperature at which the meat has been carried. At very low temperatures, considerable distortion of the fibres results, and they do not so easily regain their shape as those which have been frozen at higher temperatures. The practical application of this fact is that meat carried at very low temperatures should be thawed much more slowly than that carried at higher temperatures. This question of permanent damage to the muscle fibres is obviously of some importance, since loss of fluid means loss of valuable proteids, extractives, and salts. Fortunately there does not appear to be irretrievable damage, and the process seems analogous to that which takes place when plants are frozen, in which case water freezes outside the cell in a state of considerable purity and not within. Such freezing does not necessarily kill the plant, especially if the subsequent thawing is slow. Experiments on animals also indicate that the freezing of animal tissue does not necessarily result in serious damage to the cellular elements, or death would ensue in

[1] "The Cold Storage of Beef and Poultry," by W. D. Richardson, Chairman, Chicago Section American Chemical Society, 1st International Congress of Refrigeration.

those cases where fish frozen in ice, and submitted to a temperature of 15° C., and frogs frozen in ice, have regained their vitality on slowly thawing.

It follows, therefore, that the defrosting process should be conducted with due regard to the above requirements, and although many attempts have been made to devise mechanical means which would prove satisfactory, such as forcing air by means of a fan through the thawing rooms at progressively increasing temperatures, or the removal of frost and moisture by heated pipes, traders generally do not favour special means, since they take a few days to carry out and add to the cost of the meat. In the Nelson system the cold pipes of the ammonia expansion process provide a surface on which moisture is deposited and steam pipes are used to generate the warmth necessary to thaw the carcasses. The steam pipes are placed under grating in the floor, and the cold pipes behind screens on the side walls. The space behind the screen is open above and below. Hot air rises between the carcasses and a current is established which results in the warm moist air passing over the cold pipes. The moisture is deposited on the pipes in the form of snow, and the cold air falls to be rewarmed by the hot pipes and again rises between the carcasses. Meat thawed by this process is certainly dry and of good colour.

## The Regulation of Cold Stores

In view of the fact that imported meat arrives in this country in shiploads, and that the supply is therefore often larger than that required for immediate sale, it is necessary for traders to provide themselves with cold stores in which the meat may be kept in condition until it is required for sale. The increase in the number of cold stores is a feature of the present day wholesale meat trade. Many large retailers have also equipped themselves with this desirable accessory. In many instances the management of these stores leaves nothing to be desired; in others considerable

improvement could be effected. Sanitary supervision is becoming increasingly a matter of importance. Dirt or unsuitable substances deposited in cold stores results in objectionable consequences just as surely as do similar conditions in premises devoted to the storage of fresh meat. The necessity for supervision is greater in public than in private stores. Public stores may be used on the basis of separate parcels being deposited, and a charge made varying with the bulk and nature of the goods brought in; or stores may be sub-divided, and larger or smaller compartments given over for private use by special arrangement. When many persons use a store there cannot be the same care displayed as when the stores are under single administration. The common use of stores does not tend to improve either cleanliness or the maintenance of regular temperatures. Stores should be well lighted by electric means, not only for supervision, but to enable work to be done under the best conditions. Some differentiation of products deposited is also necessary. Mixed goods such as poultry, eggs, fish, cheese, and the like, should not be placed in compartments containing meat, and in meat stores, the drier carcasses should be separate from the moister offal. Provision should be made for adequate drainage or for frequent removal of offal drainage. Goods which are deposited in the stores should be in such a state that they are fit for refrigeration. Putrefaction is considerably masked by freezing, and no goods except absolutely fresh material free from any mustiness should be admitted. In addition, the removal of frozen goods for sale, and the consequent thawing, should be sufficient to justify objection being taken to the readmission of such goods with only rare exceptions. This matter of admission of products into stores, and the fact that freezing masks decomposition, demand that definite responsibility shall devolve upon some one to ensure that stores are used in a proper manner, and to safeguard the public against cold stores being used to help in getting rid of products which are in an unsatisfactory condition. How far responsibility attaches at present to

other than the owner of unsound goods so deposited is not clear, but in public stores in which odd products are deposited, it seems reasonable to require that the proprietors should be equally responsible with the owner of the goods as regards their condition; and where separate compartments are reserved, the sub-tenant should be responsible for his own goods, and likewise be joined in any responsibility which may devolve upon an owner to whom he grants facilities to store goods in his compartment. It would much help local authorities if definite regulations were framed dealing with these and other matters, and perhaps annual registration of ownership of cold stores, with submitted lists of sub-tenants in places where compartments are hired, would prove of service. Registers should be kept of the date of all goods admitted and discharged, and such should be available for inspection by the sanitary authority. In certain of the United States a time limit is placed by law on the period during which goods may remain in cold stores. In certain instances, provision is made for extension of the time, in others the period is absolute. In some States also, all goods are required to be stamped with the date of admission. In the present position of our knowledge it is impossible to fix a period beyond which retention in store should justify destruction, and which would operate equitably all round. As regards stamping the goods there is, perhaps, something more to be said in favour, but it cannot serve any very practical purpose; probably the fact that it would indicate that goods were deposited in season is the best reason. A register of admissions and discharges would meet most of the sanitary requirements and present no administrative difficulty. Free admission to the stores and to the different compartments and passages should at all times be granted to authorised sanitary officers.

### The Inspection of Imported Carcass Meat

As in the case of imported edible offal and boneless meat, inspection as to "condition" is a more essential

requirement in the case of carcass meat than is the subject of disease. By "condition" is not meant the qualities which the breeder considers when deciding whether an animal is fit for slaughter, but the state of preservation of the meat on arrival in this country. It is obvious that if the temperature to which the meat is exposed has been allowed to rise above a point at which decomposition changes may take place, the meat may be rendered either wholly or in part unfit for human consumption. Condition in this sense is not easily recognised whilst carcasses are in the frozen state, but indications that all is not well may be gathered from the state of the covers when the cargo is being discharged. A kind of muslin cover is placed over frozen carcasses after they are frozen, in which condition the carcasses are dry. It follows, therefore, that if no thawing afterwards takes place, there will be a minimum of staining by blood juices of these covers, and they will be practically non-adherent, which would not be the case if re-freezing has followed thawing. At the port of entry it is impracticable to examine every carcass, but in any particular consignment a breakdown will probably affect a considerable proportion of all carcasses, so that an examination of, say, ten per cent., will give a reliable indication as to the condition of the whole. The question of disease generally arises when the carcass is being cut up, either in the wholesale market or in butcher's shops.

Breakdowns in machinery will always occur, but with improvements in refrigeration plant, and the special equipment of vessels for meat transportation, these are becoming less frequent.

In the earlier days of the trade much difficulty was experienced from the formation on carcasses of moulds. These deposits were of various kinds, some being the usual superficial growths of mucor, or penicillium, whilst others formed in the superficial tissue in the form of spots of various colours belonging to the saccharomyces and oidium, and other groups. To some extent there is a relation

between temperature and their formation, since moulds are known to grow at temperatures round about freezing point; moulds and defective condition are therefore not infrequently associated. Moulds, however, will not develop without original contamination, and this problem has been almost solved by rigid attention to elementary cleanliness in the slaughtering places, the chill rooms, the holds of ships, the transporting vans, and the cloths which enclose the carcasses, and the cleanliness of those who handle the meat; and, in the case of offal, improvements in the method of packing.

To effect surface disinfection of meat, the Linley process was invented. This consists of a method whereby air charged with formalin vapour is passed into the freezing or chilling room. After remaining for a time, the formalin is replaced by cold air which has been dried by passing over calcium chloride and purified by being forced over zinc plates moistened with sulphuric acid. In the early days of this process exception was taken to the use of formaldehyde vapour, owing to the fact that it could be shown that formaldehyde penetrates into meat so treated to varying depths. In the first 5 mm. of muscular tissue unprotected by fat, it was found to the amount of one in 3500, and in the second 5 mm. to one in 10,000. Dr. Buchanan [1] reporting on the subject suggested that importers and traders concerned should consider whether the disinfection by formaldehyde should not be limited to the disinfection of the hold before the introduction of the meat.

The process is now used somewhat differently to what was then the practice. The chilling room at the place of slaughter is filled with the carcasses of that day's killing, generally to the number of 125 to 155. The temperature of the chamber before commencing to fill is brought down to 42° F. It rises during filling to from 50° to 65°.

[1] Reports to the Local Government Board by Dr. G. S. Buchanan and Dr. S. B. Schryver, D.Sc., on the Application of Formaldehyde to Meat (Food Reports, No. 9).

This is reduced to the chilling temperature, *i.e.* somewhat below 32° F., in from 28 to 36 hours. Formalin vapour is introduced into the chill room at the higher temperature, and the meat is left exposed to it for from 40 minutes to one hour. No refrigeration takes place in this interval. The cold air circulation is then set in operation, and dried and cleaned air is passed through the chamber. The meat is held up in the chill room until the time comes for exportation, and dried and cleaned air is afterwards passed through the chamber for 30 minutes every 24 hours. Originally the holds on the steamers were formalised, but that is not now the case. The chill rooms on the steamer are filled with carcasses, and afterwards only the dry clean air is passed through for periods of 30 minutes every day. Formerly one ounce of 40 per cent. formaldehyde to every 100 cubic feet of atmosphere was vaporised, but the amount now advised is 1 to 300.

## Bone-Taint

A subject which may properly be referred to under "condition" is the objectionable defect known as bone-taint. Although not so frequently met with as formerly, it is still a cause of condemnation of imported carcasses. On occasions quite a considerable number of quarters so affected are discovered, but fairly lengthy periods may elapse during which only odd instances are noted. This defect is characterised by deep-seated putrefactive changes in the thick muscles in the neighbourhood of the hip and shoulder joints, chiefly the former. There are no external appearances which would suggest the presence of putrefaction, and it is most frequently observed in the primest animals, and particularly in those slaughtered during the summer months. The condition is found on sectioning the carcass, or by exploring with a skewer in chilled, and with an augur and bit in frozen, carcasses. The cause has been variously assigned to putrefaction of the joint-oil; the

conveyance of organisms by the blood during life to deep-seated situations; the retention of animal heat; and excessive exertion or fatigue shortly before slaughter. That excessive fatigue just prior to slaughter may give rise to bone-taint, would appear most probable, since the usually sterile blood may contain organisms, temporarily, in such circumstances, which will give rise to putrefaction changes if lodged in situations where the animal heat is maintained for a sufficiently long period. It seems probable, however, that in some instances the condition is due to the insuction of putrefactive micro-organisms into the large blood-vessels at the time of dressing the carcass. The inherent animal heat is sufficient to maintain the vitality of such organisms for several days, and the desirable temperature is continued for a longer period in animals which are in the primest condition and show the thickest layer of fat. Summer heat helps, inasmuch as there are probably more of these organisms air-borne in summer than in other months, and perhaps because in the preliminary few hours' wait of the carcasses for chilling, the heat does not leave the carcass so rapidly as in colder months. Examination of the large arteries in the affected part shows that the internal lining membrane is foul and discoloured for a length of three inches or more in the deepest parts of the joint, and I have seen as many as three centres on the same side. The veins do not show the change, or if so only in lesser degree. Once putrefactive organisms are deposited within the artery, they continue to develop until checked by the cold, and the offensiveness thus generated appears to be retained, and only released on cutting into the part. Dr. Andrewes, who has examined these dissected specimens bacteriologically, reports the presence of several organisms. In one case he found *Proteus Zenkeri* and forms of bacillus coli (not communis) and *B. lactis ærogenes*. There were no anærobic organisms detected. The lining membrane of the artery contained an abundance of these organisms. The surrounding tissue contained similar organisms except

that the Proteus was absent, and the number of those found was much more sparse than in the arteries. In other cases, flesh from the offensive area was found practically free from organisms, and the hip joint contents were sterile. It is not difficult to see how organisms may reach the deeper blood-vessels. By the act of bleeding the arteries are emptied of blood and reflex contractions of the muscles submit them to compression. On relaxation of the pressure, the elastic arteries dilate, and air, containing organisms will be sucked in. When the main arteries are divided in the pelvis at the time of dressing only a few inches separate the cut end from the localities where the putrefaction arises. As it takes several days for carcasses to freeze completely, or even to chill thoroughly in the deeper parts, there is ample time for development to take place in the deep parts, particularly of those carcasses containing the thickest amount of tissue. The condition as stated is not now so frequently observed as formerly, but if it is desired to eliminate the defect completely, ligature of the artery before division, which division should be on the aorta side of the ligature, would probably prove effective in those cases which are due to outside contamination, and would not be difficult to arrange.

## Orange-coloured Streaks in the Fat of Imported Carcasses

A physiological condition which, therefore, cannot be described under either "condition" or "disease," is met with in certain imported carcasses. It is characterised by the presence of well-defined orange-coloured streaks in the fat surrounding the kidneys, and in the fat of other parts where it is deposited in considerable amount. A similar condition I have occasionally observed in home-killed animals, but whether it affects home-killed or imported animals, it is only found in the fattest and best conditioned. The defect has not been regarded as one which will cause

harm to human beings, but it is of such a pronounced character in some cases that it renders the fat unmarketable.

Dr. Andrewes, the City Bacteriologist, investigated the condition in the fat removed from a home-killed animal. It is probable that the following facts which he established would apply equally to the defect observed in imported carcasses. The change appears to occur along the small blood-vessels, which accounts for the veined appearance of the orange-coloured marking. The fat in the affected area is largely split up with formation of abundant needle-shaped crystals of fatty acids. These do not stain with iodine, and are hence a saturated fatty acid, probably stearic acid. Such a change must be brought about by a fat-splitting ferment which from the distribution of the change is probably conveyed by the blood. It has been proved by Abderhalden that when animals receive a diet containing fat in excess, such a fat-splitting ferment becomes actually demonstrable in the blood. It is therefore possible that in fattened animals a sufficient amount of the ferment is present in the blood at death to give rise to local fat splitting around the blood-vessels. Mr. McKenzie Wallis, on Dr. Andrewes' staff, examined the pigment of the yellow areas which he found could be readily extracted with petroleum ether, to some extent with ether, but not by alcohol. The solution gave the spectrum of a lipochrome. There were no bands suggesting derivation from hæmoglobin, nor was there any evidence of hæmatoidin or any blood derivative. It could not be determined whether the pigmentation was due to a concentration of the natural lipochrome of the fat, or to lipochrome brought by the blood stream.

The conclusion to be drawn from the above is that animals may be " over conditioned " with consequent loss to the salesman owing to the unmarketable characteristics which are acquired by considerable quantities of valuable fat.

## The Diseases of Imported Carcasses

The diseases to which foreign cattle are subject, differ in many respects from those observed in this country, and although it would not be possible here to enter fully into any detailed description it may be of service to direct attention to the main features. In general, it may be stated that diseased carcasses are eliminated from those exported, and to this extent a word of appreciation of this branch of inspection as conducted in exporting countries is not out of place.

The chief exporting countries and the class of product exported have already been described, and the chief affections met with are :—

| | |
|---|---|
| Australia. | Onchocerciasis in cattle. |
| Argentina. | Actinomycosis in ox tongues, and a number of instances of tuberculosis. |
| Holland. | Tuberculosis and hæmorrhagic lesions in pigs. |
| Russia. | Foot and mouth disease was noted in a number of dried tongues imported in 1913. |
| Sweden. | This country before the war exported many calves, but no exceptional incidence of disease was noted. |

Cases of caseous lymphadenitis are occasionally met with in sheep from different countries.

Organs occasionally show evidence of the usual parasitic diseases, and other conditions which may have escaped detection during inspection.

*Onchocerciasis,* which results from invasion of cattle by the parasitic worm *Onchocerca Gibsoni,* has been dealt with administratively on the following lines. The briskets, in which joint are chiefly located what are termed the worm-nests characteristic of this disease, are cut off all Australian carcasses exported to this country, and the region of the stifle joint is explored by suitable incisions for the presence

of the nodules. These mutilations of sides of frozen meat are sufficient to distinguish Australian meat from all other, and are carried out by arrangement between this country and Australia. The only difficulty which now arises is that the briskets are occasionally cut too short, with the result that the worm-nests may be found on the forequarter in the neighbourhood of the incision. This is an infrequent occurrence, and is generally the result of some easily remedied inspectorial difficulty. The loss to Australian cattle breeders from worm-nest disease must be considerable, and research work is in progress with the object of devising suitable preventive measures. The present position of knowledge appears to be that by means of a biting insect, either *stomoxys calcitrans* or *culicelsa vigilax*,[1] embryos are taken up from the bovine host. In the insect a certain stage of development takes place, and eventually the partly developed worm or worms are injected into the subcutaneous tissue of the new bovine host. Having been injected, the worms increase in size and start on their migrations. From the lower part of the leg they reach the front of the knees, and from the forelimb they reach the brisket area. Living embryos are deposited in these situations, and by means of toxic products cause a certain amount of swelling which leads eventually to some degree of fibrosis. When the adult worm is arrested, embryos continue to be released, and the reaction results in the encapsulation of the worm in the fibrous mass, which is noted in meat inspection work. The embryos in the early stage, or even after encapsulation, may escape and reach situations where they may be taken up by a biting fly.

As regards Argentine animals the following particulars given to Mr. Young, Veterinary Surgeon of the City Corporation, indicate the prevalent diseases and their frequency in that country. The figures relate to the year 1912.

[1] "Further Investigations into the Ætiology of Worm Nests in Cattle due to Onchocerca Gibsoni," by J. Burton Cleland, M.D., Ch.M. (Sydney), Commonwealth of Australia, 1914.

| | Cattle. | Pigs. | Sheep. |
|---|---|---|---|
| Total number slaughtered .. | 1,368,000 | 8922 | 3,217,367 |
| Tuberculosis .. .. .. | 4% | 19·3% | — |
| Echinococcus Veterinorum .. | 25% | — | 28·3% |
| Distomatosis .. .. .. | — | — | 2·4% |
| Actino-bacillus .. .. .. | 6407 | — | — |
| Jaundice .. .. .. .. | 1467 | — | 1713 |
| Trichinosis .. .. .. | — | 2·5% | — |
| Cysticercus Cellulosæ .. .. | — | 0·3% | — |
| Caseous Lymphadenitis .. | — | — | 3·6% |

*Actinomycosis.*—The presence of actinomycosis in Argentine ox tongues has been reported on both by the Officers of the Corporations of Liverpool and London. In London the condition is still noted, but not so frequently as two years ago, and the diseased tongues which are now observed are generally only slightly affected. The condition has been recently investigated by Dr. Griffith [1] of the Local Government Board, who considers, in a preliminary report, that the bacillus of Lignières and Spitz is responsible for the Argentine cases. He also found that 40 out of 44 English cases were caused by the same bacillus. As actinomycosis is a disease to which human beings are liable, the condition requires further investigation, and prohibition should meanwhile be continued against the importation of tongues so infected.

The condition in ox tongues chiefly affects the retro-pharyngeal glands, more rarely the blades. In the early stages the glands may not even be enlarged, but section shows the glandular elements to contain several prominent points resembling granulation tissue. In more advanced cases the glands are enlarged and filled with yellowish semi-purulent material containing sandlike gritty bodies. The disease may be mistaken for tuberculosis with which condition the Liverpool researches indicate it is frequently associated. A few years ago the precentage of affected tongues imported into London varied in different consignments between 5 and 20 per cent.

[1] Preliminary Report on the Pathology of Bovine Actinomycosis, by Fred Griffith, M.B., Local Government Board. Food Reports, No. 23.

## Muscular Hæmorrhages

The hæmorrhagic condition observed in pigs imported from Holland is apparently not the result of disease, and is probably of similar origin to the corresponding condition occasionally observed in pigs, and sometimes in cattle, slaughtered in this country. Punctate or even larger hæmorrhages in the muscular tissue of the diaphragmatic and abdominal muscles are seen in animals which are obviously in sound condition. These appear to be due to the laceration of the muscular elements and capillaries by the muscular contractions which follow stunning, particularly when several are stunned at a time, and some little interval elapses before they are bled. The condition is objectionable if very extensive, since the number of hæmorrhagic points renders the flesh unsightly, and may encourage premature decomposition. If the condition is of limited extent, the affected part may be removed and destroyed, but if extensive, condemnation of the carcass is called for.

Berger [1] has investigated this subject, and reports having observed in the situations stated, hæmorrhages of a length of from a few millimetres to two centimetres with an average width of two millimetres. Berger had control of two establishments at which pigs were slaughtered, and made the following observations. "In abattoir A, previous to May 1, 1909, the pigs were slaughtered with the mallet, in batches of twenty at a time; each pig receiving a blow with the mallet, but it was not till the whole twenty had been thus stunned that bleeding was practised. Moreover, the animals were not bled in accordance with the order in which they were stunned. While this method was followed, the hæmorrhages under consideration were very abundant at this abattoir, 2 per cent. of the pigs showing them.

In abattoir B, the pigs for a long time had been killed by the American method, viz. the animal being suspended

[1] *Veterinary Record*, September 30, 1911. "Muscular Hæmorrhages in the Muscles of the Pig."

in the air by the hind limbs and bled immediately without stunning with the head hanging downwards. In about 140,000 pigs killed in this fashion, Berger never observed the hæmorrhages.

Previous stunning was then introduced into this abattoir, and from the day of its introduction the hæmorrhages commenced to appear.

The author thinks, therefore, that the hæmorrhages may be attributed to the stunning. He has attempted to find out whether the exact method of stunning adopted exercises any influence, and he has been informed that the hæmorrhages have not been observed in abattoirs where special apparatus (the bullet, percussion, etc.) are employed. In Germany, where pigs are generally stunned by a blow from the mallet, hæmorrhages are encountered in 25 per cent. of those killed.

In abattoirs it often happens that, no order being followed, the first pigs to be stunned in a batch are the last to be bled. In abattoir A, therefore, it was arranged that no more than six pigs were to be stunned at a time before bleeding, and when this was done, it was quickly found that muscular hæmorrhages diminished.

Berger then directed that the pigs should be bled immediately after stunning, and while previous to this he had found hæmorrhages in 2 per cent. of the animals killed, he has since, up to the present time, inspected 5000 pigs without finding one case. Ruptures of the muscular fibres, however, are still observed, but as the pigs are bled immediately, the blood has little time to become extravasated into these ruptures.

It is evident, nevertheless, that hæmorrhages may be produced a certain time before slaughter by the different traumatisms to which the pigs may be exposed.

## Foot and Mouth Disease

This disease was noted as affecting several consignments of smoked tongues received in London from Russia prior to the war. They arrived from a district in which the disease

was endemic, and it was observed that the lesion varied from the early vesicular stage to healed cicatrices. A separate inspection of all tongues was called for, and a decision arrived at, that in future, consignments showing such lesions would be refused admission, as the duty of controlling such imported food rested with the authorities of the country of origin.

## The Handling of Meat

The handling of meat is a subject which affects the distribution of both home-killed and imported products. It is a matter to which attention has been often directed in the past, but no permanent improvement has so far been effected. The transportation of imported meat from the ships to the cold stores, and thence to the market, compares favourably with that of home-killed produce, but the transference of meat of either class from the market to butchers' shops often leaves much to be desired.

Many persons in country districts who slaughter only small amounts send the meat to market by passenger train, and it often happens that sufficient attention is not paid to the packing. The same observation applies to meat sent to country shops. Defective packing encourages decomposition, and inadequate covering renders the meat liable to contamination in transit.

After the purchase of meat at the wholesale market has been completed, subsequent care becomes the responsibility of the purchaser. Porters are generally engaged to perform the manual labour of conveying the meat from the stall to the carts which convey it to the retailers' premises. A porter carries meat on his back, and when large parts are so transferred it often rests on his head. In addition to the requirement that porters should frequently change their overalls, they ought also to be required to wear a washable head covering.

On arrival of meat at the carts it should not be placed at the ground level, even on wooden supports, prior to being

packed in the cart; neither should trucks conveying meat be allowed to stand in public ways uncovered, since the cut section of meat may here collect dust and dirt.

Carts designed for any purpose except the satisfactory conveyance of meat are used to convey meat from the market. Even when cleaned, unsatisfactory construction causes dirt to be left in places from which it cannot easily be removed.

Coarse brown sacking is the material I have most frequently seen used for covering meat. It is difficult to see when it is soiled, and as a consequence it is not scalded after each time of use. White washable cloths are the exception.

The bottom and sides of the cart are either covered with sacking or else with a layer of straw. In some instances the straw is below the sacking, but by no means usually. Straw is a most unsatisfactory medium on which to place the cut sections of meat.

The meat is packed in the cart without satisfactory regard being paid to the danger of street dirt being conveyed to the meat. If a white cover were laid on the bottom of the cart it could be rolled up as far as necessary, whilst a part of the van is being packed, and unrolled gradually as filling proceeds, thus covering the feet-marks of the man who must be in the cart.

Other products are often packed with the meat. Boxes of rabbits, and boxes containing other substances can often be seen either resting on the meat or supporting it. The fur of the rabbits projects through the latticed wooden cover of the box, and is often in contact with the meat. It is impossible to state with what objectionable materials wooden boxes from abroad have been in contact; and so one might enlarge upon this point.

Tarpaulins are used for the outside cover, and these are often far from clean, and sometimes come into contact with the meat, which should be avoided. Drivers are not careful. Some may be seen driving through the streets sitting on the meat. The vans are not always completely

covered ; and any day in different parts of London meat vans may be seen with a great superficial area of meat exposed to dust and dirt both at the front and back of the van.

It should be noted as emphasising these points that the meat is often not in the form of sides, but has been cut across, leaving large moist sections of meat exposed. These surfaces should be covered with grease-proof paper, and more use made of cloth coverings both for joints and for sides of beef. In the slaughter-houses due regard requires to be paid to the observance of cleanliness ; in the markets the traders vie with one another in matters of order and cleanliness ; and in the shops, retailers recognise the value of brightness and prove it by good lighting, clean benches, bright brass and steel fittings, and clean-looking tiles, but in the interval between purchase from the wholesale dealer and the reception of the meat at the shop, there is this remarkable apathy displayed by some as regards observance of elementary rules.

Although no ill results are reported as a direct consequence of present methods—for which perhaps we have to thank the cooking process to which meat is subsequently subjected—they offend sentiment and should be improved upon. It is difficult to suggest any official action which can be taken at the present time, since no specific regulation is ignored, and the negligence arises in what may be regarded as " no-man's land." Inside the markets, control is possible, and is exercised, meat being handled on many stalls in a manner which is worthy of commendation. The difficulty chiefly arises outside. The chief hope of immediate improvement rests with the butchers. Those who recognise their responsibilities in this connection should bring pressure to bear through their trade organisation on their less careful associates, and as a future direct effect it may be possible, if regulations are subsequently framed to control meat inspection, for the requirement that food shall be handled in a cleanly manner, to be incorporated in the series.

## CONCLUSIONS

In conclusion I need not say more than repeat the requirements which appear to me to be necessary to put meat inspection on a more satisfactory basis.

1. With a view to ensuring uniformity of action, *routine* meat inspection should be made a compulsory duty of all urban sanitary authorities.

2. With a view to safeguarding more adequately the supply in urban districts, there should be compulsory inspection of those slaughter-houses in rural districts at which carcasses are dressed for sale in outside areas.

3. Inspectors engaged on meat inspection work should be required to possess proof of knowledge of the subject.

4. Regulations should be framed dealing not only with the details of inspection of carcasses, but with the sanitary requirements of slaughter-houses, facilities for inspection, and, perhaps, the requirements of ante-mortem examinations.

5. A system of meat marking under the direct control of the Local Government Board should be instituted and as a commencement its adoption should be voluntary; but permission to adopt should be within the power of the Board to grant or to refuse.

6. In districts where a system of meat marking is in operation, the Local Authority should have power to require that all meat used in prepared food products should be inspected and approved before being used.

7. In view of the impossibility of satisfactorily examining in this country imported boned meat, and meat in the canned form, some of the responsibility which now devolves upon home inspectors should be accepted by the Government,

who should appoint inspectors to visit the chief places abroad where the work of boning, canning, and exporting meat generally is carried out. In this way attention could be given to the observance of hygienic requirements, and to the quality and character of the meat used.

8. Regulations should be framed to control cold stores in which food products of any kind are stored.

9. Regulations should be framed to ensure that meat is handled in a cleanly manner.

# APPENDICES

## I

## LYMPHATIC GLANDS

The vessels which convey the lymph are termed lymphatics. They take origin in the spaces which are found in the different tissues. The first conducting tubes are merely capillaries lined by single cells. These small tubes, by anastomosis, form larger vessels which ultimately are connected with one of two main lymphatic trunks, named respectively the thoracic duct on the left side, and the right lymphatic duct on the right side. These main receiving vessels discharge lymph into the venous blood stream, the thoracic duct into the anterior vena cava, and the right lymphatic duct generally into the main venous tract at the junction of the jugular veins. This latter sometimes anastomoses with the thoracic duct. The thoracic duct commences in a cystic dilation known as the receptaculum chyli, which is placed at about the level of the first lumbar vertebra. The duct passes forward through the diaphragm along the lower surface of the vertebræ to the apex of the thorax, where it enters the vein. The right lymphatic trunk is a short trunk of one or two inches in length which is formed by the junction of the efferent vessels of the right prepectoral glands. A reference to the area of drainage of these glands and their communicating glands will show that all the lymph of the body enters the thoracic duct, except that from the right fore limb, the right axillary and superficial costal regions, and the right half of the head and neck and thorax.

On the course of the lymphatics are placed the lymphatic glands. These are usually kidney-shaped structures, but they may be flat, round, or elongated. They vary in size

from a pea or smaller to several inches in length. The colour varies from white, through grey to brown or black, whilst a few glands (sub-lumbar) are red. The consistence varies with age. In old animals a hardness develops which is due to increase of fibrous tissue. The mesenteric glands are generally softer than those in other parts of the body, particularly if examined during the time digestion is taking place. The lymphatic on approaching the gland splits up into several small vessels, which enter the gland on its outer or convex surface. These are termed the afferent vessels. After passing through the gland, lymph is carried away generally by a single efferent vessel, which leaves the gland at the hilus.

Each gland is supplied by an artery which also enters at the hilus from which point also the vein emerges. On section, the gland is seen to be composed of two parts ; an outer, lighter-coloured cortical, and an inner medullary portion of darker appearance. The whole gland is surrounded by a fibrous tissue capsule, and from this, thinner strands pass into the gland forming trabeculæ, and by further sub-division, retiform tissue. The sub-division of this fibrous tissue makes a sort of scaffolding, in the spaces of which are contained aggregations of lymphoid material. The spaces between the fibrous tissue and the lymph tissue freely anastomose, and the afferent vessels lose themselves in the cortical divisions whilst the efferent take origin in the medullary anastomoses. The differences in the cortical and medullary portions depend mainly on the shape of the lymphoid conglomerations.

Lymph is of the same nature as blood plasma, but contains more waste products, and is poorer in those protein elements which do not pass through a membrane, *e.g.* serum globulin and serum albumen. It contains many colourless corpuscles, the number of which varies at different times, and at the same time in different parts of the same animal. It is richest in cellular elements as it leaves a gland. All lymph passes through at least one lymphatic gland before it is discharged into the thoracic duct or right lymphatic vein.

In passing through the gland, the lymph acquires fibrogenetic qualities, that is, the power of coagulability. Certain lymph corpuscles are added to it, and some kind of straining action also results. Thus the retention of particles

causes the dark colour and mottling observed in the glands of old animals, and although micro-organisms may possibly pass through it unaffected, others are doubtless restrained, and are either destroyed and disintegrated or they set up pathological changes by subsequent development. Parasites sometimes are restrained and likewise develop.

Lymph vessels freely anastomose, and if the lymph tract in the gland is destroyed by disease an alternative course is readily established; and also when two adjoining surfaces become adherent after plastic inflammatory processes, lymph tracts between anatomically distinct areas may become established.

## The various Lymphatic Glands

For the purpose of detailed consideration, the lymphatic glands may be divided into four groups. (1) Those of the head and neck and fore extremities, which pass on their contents to the prepectoral glands; (2) the glands of the hind extremities, and abdominal walls which reach the main lymphatic channels by the way of the lumbar glands; (3) the glands of the thoracic cavity which discharge into the thoracic duct either direct or after anastomosis with other glands in that cavity; and (4) the glands of the abdominal organs which practically always discharge lymph direct into the thoracic duct. The following description must be regarded as being only approximately accurate in certain instances, as considerable variations may be met with which prevent a strictly accurate summary; the details are, however, sufficiently nearly correct to serve the purpose of meat inspection.

### 1. *Area draining into the Prepectoral Glands*

*Submaxillary Glands.*—These lymphatic glands require to be differentiated from the salivary glands with which they are in intimate relationship in both cattle and pigs. The salivary glands are readily recognised by showing on section an irregular grouping of the glandular elements. In the ox the lymphatic glands are located between the lower jaw and the salivary gland about two inches in front of the angle of the jaw. When the tongue has been removed from the head they will generally be found on the upper and outer surface of the base of the tongue, and may be examined by making an incision into that region, the tongue being placed

for the purpose with the base towards the examiner and the dorsum upwards. In the pig, the gland is placed more posteriorly, and therefore nearer the angle of the jaw.

*Retropharyngeal Glands.*—In the ox there is a fairly large gland on each side of the middle line between the branches of the hyoid bone on the upper and posterior surface of the pharynx. If the tongue has been removed, they may be found on the base of that organ, if the disconnecting incision has been extensive. If not in that position they will be found on the back of the pharynx. In the ox, if the tongue has not been removed, these glands will be exposed if the head is placed with the frontal bones on the table and the base towards the inspector, by an incision commencing at the side of the pharynx and directed downwards towards the upper part of the pharynx and finishing well down on the bony structures. The larynx should be drawn upwards to help the inspection. In the pig the glands are smaller, placed more posteriorly and more on the lateral wall of the pharynx. They are usually found embedded in fat near the tip of the styloid process of the occipital bone.

*Parotid Glands.*—In cattle this series of glands is covered by the upper and anterior edge of the parotid salivary gland. They are to be found on a line just below the external meatus, and an inch or so in front of it. In the pig the glands are numerous and red in colour. They are located along the anterior edge of the parotid gland in a position just behind the posterior border of the ascending ramus of the lower jaw. If the head has been detached from the rest of the carcass by what is termed a "short cut," they will be exposed, in the incision on the carcass, or possibly they may be divided. Other lymphatic nodes may be found at a lower level in the salivary gland.

*Superior Cervical Glands.*—In the ox, these glands will be found near the base of the skull above the pharynx and under the styloid process of the occipital bone, and in close proximity to the upper end of the submaxillary gland. In the pig they are placed on the walls of the upper part of the trachea and œsophagus.

*Middle Cervical Glands.*—These glands are a continuation of the superior cervical glands along the walls of the trachea and œsophagus. They are often absent in cattle.

*Prescapular Glands.*—In the ox these glands are situate

just above and to the inside of the shoulder joint under cover of the mastoido-humeralis muscle. They may be reached either from the outside or inside of the carcass. The external incision requires to be 3 or 4 inches long in a direction parallel to the fibres of the muscle named, and at a point to the inner side of the shoulder joint. The gland is somewhat deeply placed in fat, and the muscle requires to be pressed aside to get at it. In pigs, the gland may be examined from inside " by making a transverse cut just in front of the shoulder joint from the nape of the neck to the trachea, some distance anterior to the first rib. The gland will be found about the middle of the incision." (Buckley and Castor. Lohoff.)

As this gland receives lymph wholly from an area unconnected with either the digestive or respiratory tract, it has a most important bearing upon decisions in cases of tuberculosis.

The gland is not generally examined without special reason, as the incision somewhat mutilates the carcass.

*Axillary Glands.*—These glands are placed among the vessels and nerves on the inner surface of the scapula posterior to the shoulder joint. There is generally more than one nodule, and in pigs they are often absent. The glands are reached from the inside of the carcass by an incision along the anterior border of the first rib through the muscular tissue connected with the rib, the middle of the incision corresponding to about the middle point of the rib. It can only be got at from the outside by removing the scapula. The gland is not usually examined.

*Prepectoral Glands or Inferior Cervical Glands.*—These glands are placed at the entrance to the thorax and extend into the anterior mediastimun. They are supported on the first two ribs in close proximity to the trachea, and the large vessels of the neck. A longitudinal incision through these vessels will expose the glands.

In view of the fact that they receive lymph from certain of the thoracic glands, and also from the prescapulars, their importance in the case of inspection of carcass meat unaccompanied by organs is considerable, as they may provide evidence of tuberculosis though the affected organs are not available for examination. (The anterior mediastinal and supra-sternal glands will be described with the glands of the thoracic cavity.)

### 2. *Area draining into the Sublumbar Glands*

*Popliteal Glands.*—These glands are placed deep down behind the knee joint on the gastrocnemius muscle near the point of bifurcation. In pigs they are sometimes absent, and in these animals a small gland is often found about three or four inches above the hock. The glands are reached in cattle by an incision behind the knee joint, between the biceps femoris and semi-tendinosus muscles at the level of the middle of the patella. The line of the incision in the hanging carcass is " from the point of the ischium to the point of the os calcis." The muscles require to be separated to bring the gland into view. A similar incision exposes the gland in pigs.

This gland is not examined as a matter of routine, but when exposed and found to show tuberculous lesions, it is of equal importance with the prescapular in similar circumstances.

*Ischiatic Glands.*—" These glands are located on the deepest and outer part of the lesser ischiatic notch, adjacent to the external surface of the bone, covered by the broad ligament of the pelvis, on the ventral border of the coccygeal muscle " (Buckley and Castor). They are rarely examined, but are often noted in the London cuts in the incision which separates the aitch bone and the rump joints. In imported carcasses this gland sometimes shows abscess formation, the result of tuberculosis or perhaps actinomycosis when no other evidence can be found.

*Precrural Glands.*—In cattle these glands will be exposed by an incision in the loose tissues of the flank running along the anterior border of the tensor fasciæ lata muscle at a point which is about half-way between the external crest of the ileum and the patella. In pigs, the gland may be reached from inside the carcass by making a slanting incision in the abdominal wall corresponding to the border of the fascia lata muscle at the level of the sacro-lumbar articulation. This gland must be grouped with the prescapular and popliteal glands as regards importance from the meat inspection point of view. It helps in arriving at a decision as to whether tuberculous lesions have become generalised.

*Superficial Inguinal (male) and Supramammary Glands (female).*—In uncastrated males these glands will be found

at the neck of the scrotum, and in castrated animals in the scrotal fat. In cows they are located behind the mammary gland in its upper part on each side. In pigs the position is similar, the glands being posterior to the last division of the mammary gland in sows.

*Sacral Glands.*—Small glands placed on the internal surface of the sacrum near the lateral borders. They are not usually examined.

*External Iliac Glands.*—These will be found in the angle formed by the division of the circumflex iliac artery at the external border of the psoas magnus muscle. They are not examined as a matter of routine.

*Internal Iliac.*—These glands are located in the angle formed by the external iliac artery, and the abdominal aorta at a point corresponding to the upper third of the pelvic arch. There is generally one single large gland in cattle, and several in pigs.

*Sublumbar Lymph Glands.*—These are fairly prominent glands on the under surface of the bodies of the lumbar vertebræ. They are embedded in the fatty tissue which is seen along the line of the main vessels in the abdomen. Longitudinal incisions in this situation will expose them.

*Other Glands.*—A few other glands of no considerable importance are described. There is a number of small subcutaneous glands in the flank which pass on lymph to the precrurals. *Deep inguinal* glands have been described, which though found in the horse are very small in cattle, even if they exist. The *anal* lymph glands constitute a small group which receive lymph from the anal region, and are situate on the floor of the pelvis. None of these glands are usually searched for by meat inspectors.

### 3. *Lymphatic Glands of the Thoracic Cavity*

*Subdorsal or Superior Thoracic Glands.*—In cattle these glands are to be found embedded in the intercostal muscles in the intercostal spaces on each side of the bodies of the vertebræ. In pigs they lie below the dorsal vertebra and on the aorta.

*Supra-sternal or Inferior Thoracic Glands.*—In cattle these glands form a chain which rests on the inner surface of the sternum near the junction of the cartilaginous portion

of the ribs with that bone. They follow the line of the internal thoracic artery and vein, passing with these vessels under the triangularis sterni muscle. The lowest gland is located in the fatty layer at the attachment of the diaphragm to the sternum. In pigs this series is generally replaced by one gland which will be found on the fore part of the internal surface of the sternum.

*Bronchial Glands.*—In both cattle and pigs there are glands which are closely associated with the right and left bronchi at the point where the bronchi enter the lung tissue. In pigs they are often duplicated. In association with the right lung there are usually two glands, one draining the anterior lobe and the other the main right lobe. The left bronchial gland which is the one most frequently examined is generally the largest of the bronchial glands. This gland drains the left lobe of the lung, and is placed on the left side of the trachea near the main bronchus on that side. An incision across the left bronchus near the lung generally cuts through this gland. A small posterior bronchial gland may be found located behind the division of the trachea into the main bronchi.

*Mediastinal Glands.*—These glands are generally divided into anterior and posterior, the differentiation depending upon their relationship to the heart. The anterior glands consist of a small group in the anterior mediastinum which are placed on the inferior and lateral aspects of the trachea and œsophagus in the anterior part of the thorax. The posterior mediastinal glands are located, as suggested, in the posterior mediastinum and are readily found in the rearmost part of that area. The most posterior gland of this series is the largest of the thoracic glands in the ox. In pigs the corresponding glands constitute a group of smaller glands which are in close relationship to the aorta. The posterior mediastinal gland, it should be noted, receives lymph from part of the anterior surface of the liver. The anterior mediastinal glands are of considerable importance in meat inspection since they receive the efferent vessels of some of the bronchial glands, and may be found on the carcass when the lungs and attached glands are not available for examination.

The areas drained by the thoracic glands and their commoner connections may be set out as follows :—

The right bronchial glands discharge lymph as a rule into the anterior gland of the posterior mediastinal group. They may, at times, have a direct connection with the thoracic duct. The glands drain the lymph from the right anterior and main lobes of the lungs on the right side.

The left bronchial gland receives lymph from the left lobe of the lung and the posterior bronchial from the mediastinal pleura and bronchi. Both communicate with the anterior mediastinal glands.

The anterior mediastinal glands receive lymph from the pleura, œsophagus, pericardium, and heart. and also receive the efferent vessels from the left bronchial gland. Of the posterior mediastinal glands, the anterior node receives efferents from the right bronchial glands and the posterior node drains the lymph from the pleura surrounding the posterior mediastinum, the diaphragm, the œsophagus, and the anterior aspect of the liver. Both this and the last-named gland discharge lymph into the thoracic duct.

If the mediastinal glands are left behind on the dressed carcass those located in the anterior space may be found at the entrance to the thorax on one or other side of the carcass, or the group may be divided. Similarly the anterior of the posterior nodes if left on the carcass would be found at about the level of the fourth or fifth ribs to the right of the aorta, and the larger posterior node adjacent to the pillars of the diaphragm.

### 4. *Lymph Glands, of the Abdominal Organs*

*Renal Glands.*—These glands lie in the fatty tissue about the hilus of the kidney in close proximity to the renal artery.

*Gastric Glands.*—In cattle there are two sets of glands, one a series of small nodes located on the greater curvature, and the other a series of more prominent glands in the folds which occupy the space between the second and fourth stomachs, and along the line of the gastric blood-vessels. In pigs there are three or four glands along the lesser curvature which are partly covered by the pancreas, and are in close proximity to the hepatic glands. There is a small part of the fundus of the stomach in pigs, the lymph from which passes to the splenic gland. It is also probable that

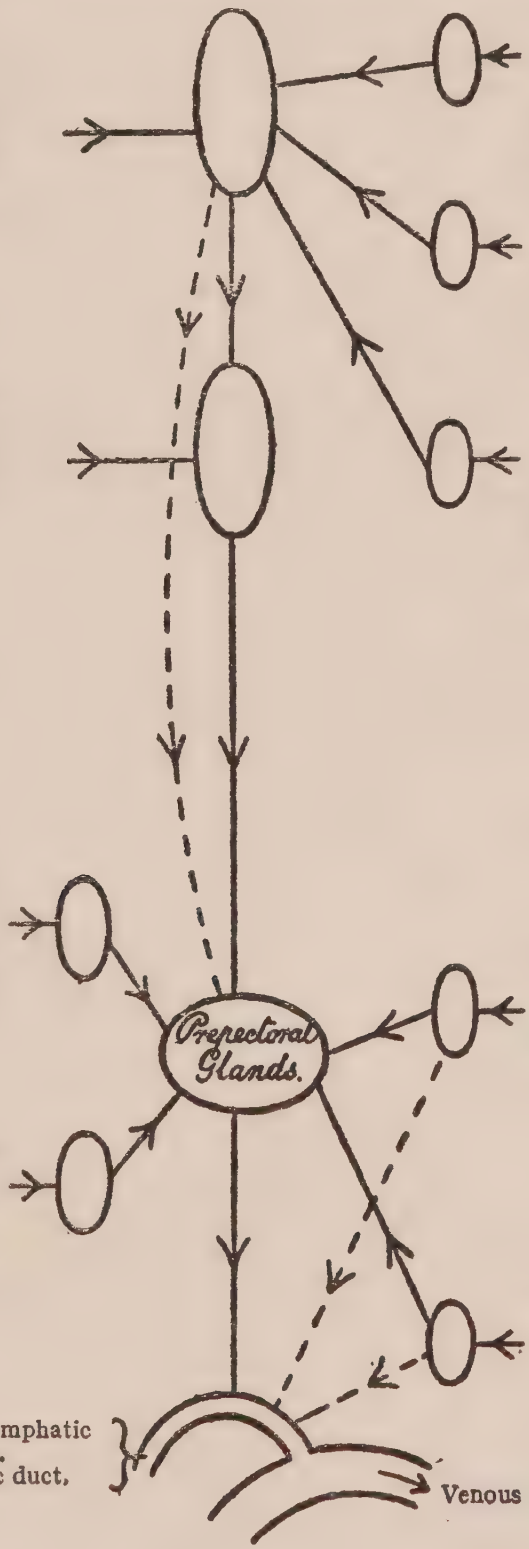
in cattle, lymph reaches the splenic gland from the stomach wall.

*Mesenteric Glands.*—These glands are contained in the mesentery and form a continuous chain running along the lesser curvature of the intestines. In pigs, the glands are nearer the centre of the mesentery than in cattle. They receive the chyle which has been prepared by the intestinal glands, and their consistence, and to some extent appearance, varies with the process of digestion.

*Splenic Glands.*—In both cattle and pigs these glands lie within the folds of the ligaments supporting the spleen, and near the hilus.

*Hepatic Glands.*—In cattle these glands lie on the ventral surface of the liver in the fat near the portal fissure. In pigs they lie on the portal vein at the foramen of Winslow. In pigs, they may be left behind after removal of the liver, in which case they will be found lying near the gastric glands. The contents of the above are discharged into vessels which are directly connected with the receptaculum chyli. The drainage areas are the organs in the case of the splenic, renal, and hepatic (or portal) glands, and in the case of the mesenteric and gastric, the submucosa, and walls of the intestines and stomach. It should be noted that the splenic gland has a probable association with a limited portion of the walls of the stomach, and that part of the anterior surface of the liver drains into the posterior mediastinal gland.

## Diagram to Illustrate the usual Drainage Area of the Prepectoral or Inferior Cervical Lymphatic Glands.




*Superior Cervical Glands.*

Pharynx, larynx, and surrounding tissues. Receives different branches as shown.

*Middle Cervical Gland.*

Œsophagus and trachea. (Non-existent in cattle, continuous with superior cervical in pigs.)

*Prescapular Gland.*

Superficial parts of the shoulder and upper and lower leg; posterior part of the chest; superficial parts of the base of the neck; and part of the inner face of the scapular region.

*Axillary Gland.*

Middle and inner scapular region, lower arm, fore-arm and foot, and the thoracic wall. (Often absent in pigs.)

*Parotid Gland.*

Chiefly deep lymphatics. Anterior and lateral parts of head, temporal and parotid region. Cranial cavity, base of skull, tongue, soft palate, œsophagus, and larynx.

*Submaxillary Gland.*

Chiefly superficial lymphatics. Mucous membrane of anterior nares, muscles of lip and cheek, tissues of anterior maxillary space, and anterior portion of the tongue.

*Retropharyngeal Gland.*

Posterior nares, cranial cavity, posterior portion of the mouth, tonsils, and pharynx. Efferent branches from other lymph glands of the head.

*Inferior Thoracic or Suprasternal Gland.*

Rectus abdominalis, and intercostal muscles, parietal pleura and diaphragm.

*Anterior Mediastinal Gland.*

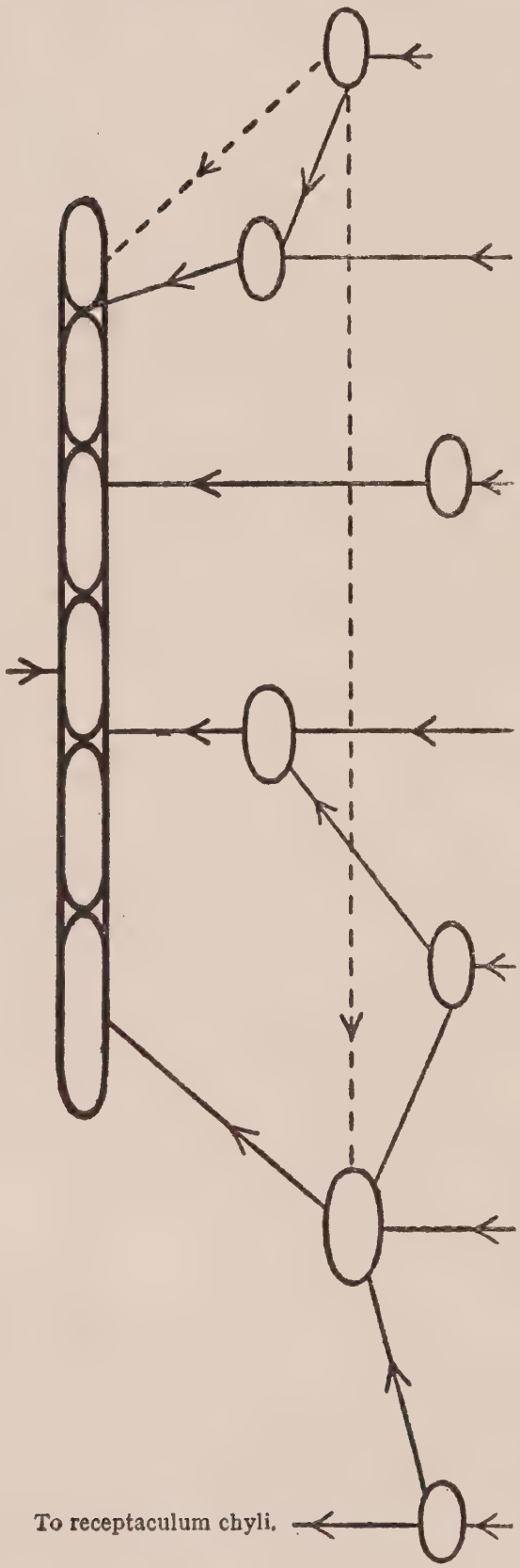
Pleura, œsophagus, pericardium and heart. Efferent branches from the small posterior bronchial gland.

On the right side = Right lymphatic trunk.
On the left side = Thoracic duct.

Venous blood system.

Arrows indicate direction of lymph flow. Dotted lines indicate alternative routes.

## Diagram to Illustrate the usual Drainage Area of the Sub-lumbar Lymphatic Glands.



*Popliteal Gland.*

Lower part of the hind leg.

*Ischiatic Gland.*

Pelvis and muscles of the rump. Receives lymph from popliteal gland.

*Sacral Glands.*

Coccygeal and sacral regions. Rectum and internal genital organs.

*Sub-lumbar Glands.*

Lumbar muscles and postero-superior abdominal walls. Receives the efferent vessels from practically all glands posterior to them. The efferent vessels from the sub-lumbar glands enter the receptaculum chyli.

*External Iliac.*

Postero-internal abdominal wall. Lateral surface of upper thigh. Receives branches from the precrural gland.

*Precrural Gland.*

Lateral abdominal walls. Superficial aspect of thigh. Outer and superior parts of the hind extremities.

*Internal Iliac.*

Abdominal walls and pelvic cavity. Pelvic bones and sacrum. Rectum, bladder, and internal genitals. Branches from precrural and supra-mammary.

*Supra-mammary and Superficial Inguinal.*

Posterior abdominal wall, and thigh. Genital organs in the male. Mammary gland in the female.

To receptaculum chyli.

Arrows indicate direction of lymph flow. Dotted lines indicate alternative routes.

## II

# THE INSPECTION AND MANNER OF PACKING IMPORTED OFFAL AND BONELESS MEAT

CONSIDERABLE attention has been paid by importers to the packing of offal so as to avoid deterioration during transportation. It is necessary that three main objectives shall be in mind, viz.: (*a*) that the offal shall be so packed as to facilitate inspection; (*b*) that the products shall be frozen in such a manner that putrefactive changes are not encouraged; and (*c*) that the process to which they are submitted will not result in physical alterations beyond what is unavoidable so that they may not be reduced in value.

Any method which will facilitate inspection is of importance, for unless satisfactory arrangements are made, the thawing of a large number becomes necessary, and perhaps no imported products suffer so much from deterioration as a consequence of thawing than does offal. It is equally of importance that the inspection in the country of origin shall be sufficiently keen to ensure that practically all diseased organs are excluded. If care in this respect is not exercised, and as a consequence a fair proportion of a ten per cent. selection shows disease, complete or partial thawing of the whole consignment becomes necessary with serious financial consequences to the importers.

Putrefaction results from too thick layers being frozen without adequate pre-cooling, since heat is retained for a sufficiently long period for putrefactive changes to set in before the cold can inhibit the development of the organisms on which the changes depend. Even if actual offensiveness does not arise at the time, the initial stages of the process may have commenced, which will result in rapid advance when the organs are thawed for sale. Soiling of organs with blood and other substances assists putrefaction.

The following description may be of interest to those who rarely have to examine large consignments either at the port of entry or at wholesale markets, since they indicate suitable methods intended to minimise the risks referred to.

Boneless meat is subject to similar requirements and risks, and the tabulation referring to imported boneless meat is that prepared by Dr. Hope of Liverpool.

*Imported Offal.*—The various products comprised within the term offal, include hearts, livers, lungs, sweetbreads, kidneys, tongues, and ox tails. This enumeration indicates that it is less practicable to examine every separate organ than it is to examine every imported carcass. It is experience in the matter of small details which enables an inspector to decide the degree of inspection to which any special consignment shall be subjected. Imported organs are liable to be affected by disease, but the chief concern of the inspector is in respect of putrefactive changes which may require that the organs shall be thawed out if a reliable decision is to be made. This thawing-out process is attended with considerable objection from the point of view of the trader, since organs once thawed cannot be re-frozen and so satisfactory a condition as before be assured. The inspection, therefore, should require as little thawing as may be compatible with efficiency, and it is principally a knowledge of the refinements of packing, variations from which may result in discoloration of the product, which is of importance to the inspector. A brief description of suitable methods of packing may not be out of place, though it must not be assumed that those described represent the only one to be adopted.

### (*a*) *The Offal of Lambs and Sheep*

*Kidneys.*—These organs should have the fat and blood-vessels removed, leaving nothing but the bare organ. They should not be separately frozen as they are liable to have the surface damaged by the frost; generally they are frozen in two layers of about thirty in each, the two layers being frozen hard in a suitable retainer. In this form they are readily examined, which should be done by thawing out a box taken here and there from the bulk.

*Livers.*—These should be packed flat without any folding

of the parts, and each enclosed for preference in grease-proof paper. They should be frozen separately before packing. Livers frozen in a mass are difficult to examine without thawing out the whole contents of the box which may contain a considerable number. The deterioration in such cases, unless the inspection is made at the retail shop where the trade is such that little delay will result, is considerable.

*Sweetbreads* should be packed and frozen in thin separate layers of about an inch in thickness, and not as separate organs, the fat being first removed. These thin layers may be packed in cases in varying numbers, but it is undesirable to have too many in a case. If the organs are frozen in a bulk of 5 or 6 inches or more in thickness there is a risk that putrefactive changes may set in before the mass is frozen, and this, of course, is encouraged by non-removal of the fat or if the products are soiled with blood. Inspection is easier and there is less liability to damage of the goods if the layers are thin.

*Hearts.*—Hearts may be frozen separately and packed twelve in a stockinette bag, five of which bags may be contained in another bag of coarser material. If a portion of the main blood-vessels is left attached to the organ, moulds will show on that part first if the temperature has been raised to a point which favours the growth of moulds or putrefaction. The reason is obvious, this portion being the thinnest part of the organ, will become most rapidly defrosted, and in a state to favour the growth of moulds.

*Plucks.*—These should not be frozen in bulk, but separately, and the constituent parts should not be folded. It is better for each organ to be wrapped up separately in grease-proof paper. If frozen in bulk the chances of decomposition arising are increased.

*Tongues.*—Each should be frozen separately.

### (*b*) *Beef Offal*

*Kidneys.*—If packed two deep the result will generally be satisfactory.

*Hearts.*—As for lamb hearts, but the size reduces the numbers which may be packed in the separate bags. Two organs in the small bag and six small bags to one large one is perhaps usual.

*Sweetbreads.*—These are generally bleached before being packed by plunging them into scalding water. After cooling they may be frozen in layers of the thickness of one organ. Sometimes they are frozen separately. They should have the fat removed before freezing, for reasons already stated.

*Ox-tails.*—Ox-tails are generally better packed in bags than boxes. In the latter case any temporary rise of temperature is not so easily overcome when the temperature is lowered again owing to the protective power of the wood. Changes are therefore more often observed in boxed ox-tails than in those contained in bags.

*Ox-tongues.*—These organs are liable to be affected with tuberculosis, actinomycosis, and foot and mouth disease, so that in addition to the question of condition, they should be specially examined for these diseases. These organs are generally packed tightly in two rows in boxes, and then frozen. The tongues are so placed that the roots of the two rows are on different sides of the box. In this way a good shape is given to the tongue, and no difficulty is experienced on examination. Occasionally separately frozen tongues are packed in bags.

*Boneless Beef.*—To facilitate examination, the freezing and packing of boneless meats must be carefully attended to and the following points noted :—

A.—*To facilitate the identification and character of goods for Customs and other purposes.*

1.—There must be a true declaration of the contents of the bag or package.

2.—Cuts of the same kind, only, must be placed in the same bag or package, there must be no mixture.

3.—The goods must be carefully manifested giving the number of packages of each kind of cut to be found in the shipment.

B.—*To facilitate Inspection.*

1.—The parts must be frozen separately.

2.—Under Foreign Meat Regulations, Class 1, no Scraps or Trimmings can be imported.

It is particularly requested that the cuts of meat shall be as large as possible, and when

boned, must be brought in as near as possible the natural shape, no rolling or folding can be allowed.

If the goods are found to be folded and rolled it will be necessary to thaw them out.

| Cut of meat. | Shape in freezing. | Serous surfaces. | Glands. |
|---|---|---|---|
| Flanks. | Frozen flat. | In the case of thin flanks the peritoneum to be left exposed. | — |
| Necks. | Full necks, and natural shape as cut off the quarter. | — | — |
| Shins. | A full shin; natural shape. | — | — |
| Buttocks. | To be laid open to expose interior (not folded) this especially in the case of inferior quality of beef. | — | Popliteal gland to be exposed for examination. |
| Clods. | Natural shape as cut from quarter. | Pleural surface not removed. | Prescapular gland to be exposed and left. |
| Loins. | Natural shape as cut from quarter. | Peritoneal surface not removed. | Lumbar glands left *in situ*. |
| Loins and Flanks. | Frozen flat. | Serous (peritoneal) surface not removed. | Lumbar glands left. |
| Chucks. | Natural shape as cut from quarter. | If the cut be large, pleural surface to be left. | Prescapular gland to be left for examination. |
| Ribs. | To be left flat after boning. | Pleural surface to be left (no stripping). It is inadvisable to remove the ribs and with them the pleural surface when boning this cut. | — |
| Middles. | As ribs. | As ribs. | As ribs. |
| Shoulders. | Ought to be cut large and frozen flat. | If cut through the chest cavity, membrane and glands to be left. | Where glands present to be left *in situ*. |
| Rumps. | Left in natural shape and frozen. | — | Do. |
| Briskets. | Frozen flat, no folding. | Membrane left *in situ*. | Glands left *in situ*. |

## III

# A NOTE RELATING TO THE CONDITIONS REFERRED TO ON PAGE 43

THE conditions referred to below are illustrative of the matters on which definite official guiding would not fail to be useful to inspectors; they do not include all to which reference might be made. The regulations governing meat inspection in the United States of America, for which the Department of Agriculture is responsible, have been set out so far as they refer to the subjects mentioned. These regulations are dated July 15th, 1914.

*Actinomycosis.*—Section 5. Paragraph 1.—Carcasses of animals showing generalised actinomycosis shall be condemned.

Paragraph 2.—Carcasses of animals in a well-nourished condition showing uncomplicated localized actinomycotic lesions may be passed after the infected organs or parts have been removed and condemned, except as provided in paragraph 3 of this section.

Paragraph 3.—Heads affected with actinomycosis (lumpy jaw), including the tongue, shall be condemned, except that when the disease of the jaw is slight, strictly localized, and without suppuration, fistulous tracts, or lymph gland involvement; the tongue, if free from disease, may be passed.

*Immaturity* is not uniformly dealt with. In certain districts a calf is regarded as being immature if it does not weigh 40 lbs., in others, age is regarded as the deciding factor. Regulations of the Netherlands Government prohibit the exportation of calves to Great Britain weighing less than 21½ kilos (about 47½ lbs.) without the head, the skin, and the abdominal intestines. The Meat Supervision Act of Victoria, 1900, provides that a calf cannot be sold or exposed or offered for sale under the age of 14 days, or if under 14 days, then under 40 lbs. in weight, including the skin, but excluding the entrails, head and feet. Standards based on age or weight are not scientific. A positive statement cannot always be made as to the age, and as regards weight,

there may be small mature calves as well as large immature ones. The byelaws of the Corporation of London appear to meet this difficulty, since they require that (Byelaw 17) every occupier of a slaughter-house shall, as often as occasion may require, give information to the Medical Officer of Health of the presence in such slaughter-house of any carcass of a calf less than three weeks old or less than 48 lbs. in weight.

The decision as to whether such an animal is fit for human consumption is based on the general appearances presented by the flesh, general muscular development, freedom from moisture, and the state of development of the fat. The regulation in force in the United States which deals with this matter is in the following terms :—

Section 21. Paragraph 1.—Carcasses of calves, pigs, kids, and lambs, too immature to produce wholesome meat shall be condemned. Such carcasses shall be considered too immature to produce wholesome meat if (*a*) the meat has the appearance of being water-soaked, is loose, flabby, tears easily, and can be perforated with the fingers ; or (*b*) its colour is greyish red ; or (*c*) good muscular development as a whole is lacking, especially noticeable on the upper shank of the leg, where small amounts of serous infiltrates or small œdematous patches are sometimes present between the muscles ; or (*d*) the tissue which later develops as the fat capsule of the kidneys is œdematous, dirty yellow, or greyish red, tough, and intermixed with islands of fat.

Paragraph 2.—All unborn and stillborn animals shall be condemned.

*Jaundice.*—The yellowish-coloured fat of old cows and of younger animals of certain breeds, or of animals fed on certain food must be regarded as a normal condition; it is only when noted in exceptional degree, accompanied by want of skill in the inspector, that the error of condemnation may result. Jaundice, however, which results from infiltration of the tissues with biliary colouring matter or altered blood pigment is a condition which calls for consideration and decision. The following regulation bears on this point :—

Section 13.—Carcasses showing any degree of icterus with a parenchymatous degeneration of organs, the result of infection or intoxication, and those which show an intense yellow or greenish-yellow discoloration without evidence of infection or intoxication, shall be condemned. Carcasses affected with icterus, the result of conditions other than those before stated in this section, but which lose such discoloration on chilling, shall be passed for food, whilst those which do not so lose such discoloration may be passed for

sterilisation. No carcass affected with icterus may be passed for food or for sterilisation unless the final inspection thereof is completed under natural light.

*New Growths.*—Section 7.—Any individual organ or part of a carcass affected with carcinoma or sarcoma shall be condemned. In case the carcinoma or sarcoma involves any internal organ to a marked extent, or affects the muscles, skeleton, or body lymph glands, even primarily, the carcass shall be condemned. In case of metastasis to any other organ or part of a carcass, or if metastasis has not occurred, but there are present secondary changes in the muscles (serous infiltration, flabbiness or the like), the carcass shall be condemned.

*Parturition* is not necessarily associated with disease, but some variation in decision is observed. If unaccompanied by septic changes, or even if slaughter has followed difficult labour, but provided no abnormality of the flesh resulting from excessive exhaustion is observed, it might be difficult to justify condemnation. In all cases of recent parturition the soft parts of the pelvis show alterations which require more or less condemnation, and this, combined with the fact that septicæmic conditions are not always easily recognised in the carcass, would appear to justify exception being taken to the use for human food of the carcasses of cows within 8 or 10 days of parturition. Advanced pregnancy does not call for condemnation unless there is an objectionable condition of the flesh, resulting from hydræmia or defective bleeding. The following regulation is enforced in America :—

Section 20.—Carcasses of animals in advanced states of pregnancy (showing signs of parturition), also carcasses of animals which have within ten days given birth to young, and in which there is not evidence of septic infection, may be passed for sterilisation ; otherwise they shall be condemned.

*Emaciation.*—The differentiation between leanness and emaciation is not always easy, but it is essential on occasions that a decision shall be arrived at. Leanness being a physiological condition does not justify condemnation except in most rare circumstances. Emaciation, on the other hand, being a pathological condition, generally does. An attempt to assist the inspector is contained in the following regulation :—

Section 19.—Carcasses of animals too emaciated or anemic to produce wholesome meat, and carcasses which show a slimy degeneration of the fat or a serous infiltration of the muscles, shall be condemned.

## IV

# THE SALE OF STERILISED UNSOUND MEAT [1]

SOME important differences exist between the standard of judgment of unsound meat in this country and in other European countries, and, to a less extent, in the United States. Local circumstances and habits may partly account for this, but not entirely. Perhaps the most important difference in habit is the fact that in Great Britain very little meat is consumed except in the cooked state, whilst on the Continent the consumption of uncooked food is a common practice; and as regards local circumstances the trade of canning meat is more important in America than here.

When it is remembered that adequate cooking will remove many of the risks which attend the consumption of unsound food, it might be expected that regulations controlling meat inspection in countries in which uncooked food was consumed would be in the direction of greater stringency in the disposal of unsound meat than in those where the contrary custom existed. This, however, is not the case, and the higher standard of this country is due to the fundamental fact that only a two-grade basis exists, whereas in many European countries there is a three-grade basis.

The two grades are (*a*) meat which is unconditionally passed as fit for human consumption; and (*b*) all other meat, which is condemned as being unfit. In countries with the three-grade standard two accord with the English requirements, whilst the intermediate grade allows of meat of inferior quality, and in some cases, meat which would be condemned and destroyed in this country, being sold under defined conditions either in the fresh state or after having undergone an approved form of treatment.

[1] A Report to the Sanitary Committee of the Corporation of London, March, 1917.

In certain countries on the Continent, the intermediate grade of meat includes parts of the carcasses of animals which have suffered from tuberculosis, swine fever, swine erysipelas, certain febrile conditions, measles, etc. The sale of this meat is restricted to special premises which receive the name "Freibank." This restriction clearly indicates that the food there sold is of inferior quality and is equivalent to a declaration. In some of the large towns no fresh meat is sold in the Freibanks; it is all treated in some approved manner.

Approved forms of treatment include: (*a*) boiling, which has the disadvantage that much of the nutriment passes out of the meat in the process; (*b*) steaming, which is perhaps the best method as it ensures complete sterilisation with the least loss of valuable qualities; (*c*) the removal, under high temperature, of the fat from tuberculous carcasses and the destruction of the rest of the carcass; (*d*) pickling, which has only a limited application and is used in the case of certain diseases of the pig, as erysipelas and swine fever; and (*e*) freezing, which process is used to destroy the lesser infestations of carcasses with measles.

The meat sold in the Freibank is intended for consumption only by the purchaser, and no hotel, restaurant or eating-house proprietor may purchase it, since the character of the meat could not be declared to the consumer. For a similar reason no butcher or maker of prepared foods may purchase it. The amount which may be purchased by any person is limited to 3 kilos (about 6 lbs.) a day.

In the United States the introduction of an intermediate grade is a recent development. It is limited in its application and the method of the sale of such food differs from European practice. In certain cases of tuberculosis, when the lesions are so distributed that they may be removed, and are such as might be regarded as being intermediate between what requires condemnation and that which justifies a carcass being regarded as fit for human consumption, meat may be passed for sterilisation. Similarly, pig carcasses showing minor degrees of infestation with measles (*Cysticercus cellulosæ*) may be approved for sterilisation, and measled beef carcasses, *i.e.* those infested with *Cysticercus bovis*, may, in varying circumstances, be totally condemned, be passed for sterilisation, or be passed as fit for human

consumption after undergoing a process of pickling or refrigeration with, of course, the removal of recognisable affected parts.

Another important difference from the English practice is seen in the regulations governing infection with swine fever, which are as follows :—

(*a*) If the carcass shows lesions in the kidneys or in the lymph glands or in both, accompanied by characteristic lesions in some other organ or tissue, then all such lesions shall be regarded as those of hog cholera, or swine plague, and *the carcass shall be condemned.*

(*b*) If the carcass shows in any organ or tissue other than the kidneys or lymph glands, lesions of either hog cholera or swine plague which are slight and limited in extent *it shall be passed for sterilisation* in accordance with Regulation 15.

(*c*) If the carcass shows no indication of either hog cholera or swine plague in any organ or tissue other than the kidneys or lymph glands *it shall be passed for food* unless some other provision of these regulations requires a different disposal.

The regulations of the United States in the matter of sterilisation require that meat passed for sterilisation if used for human food shall only be sold under declaration. The carcasses and parts may be rendered by approved processes into lard or tallow, or they may be used for food purposes, but presumably only as canned meat and provided the container is plainly and conspicuously marked so as to show that the product is second grade, class or quality, and has been sterilised.

In the English regulations it is not permissible to use any carcasses affected in the manner stated for human food. Carcasses of animals suffering from swine fever are never brought into the market if the disease has been recognised, as the condition is one controlled by the preventive regulations of the Board of Agriculture. Measled beef or pork is only rarely met with, but the slightest presence of the parasites in flesh would result in condemnation. No recognisable fevered meat would be approved, and the only condition of unsoundness to which consideration would be given, as to whether parts of affected carcasses might be used for human consumption, is tuberculosis.

The limitation of the disease to tuberculosis simplifies the problem. It should be noted that the total condemnation of tuberculous carcasses is recommended : (*a*) when a reasonable possibility exists that tubercle bacilli, bacilli which are undoubtedly able to affect human beings and give rise to the condition known as tuberculosis, have been conveyed to parts of carcasses by the arterial blood-stream ; (*b*) when the animal shows signs of emaciation ; and (*c*) when there is evidence of the flesh being deteriorated owing to secondary infection of the animal by pus organisms. In no circumstances would carcasses presenting symptoms grouped under (*b*) or (*c*) be regarded as fit for human consumption. As regards group (*a*) the danger to be apprehended is that bacilli may exist in parts of a joint where in the ordinary process of cooking the temperature at which death of the organism is certain to result might not be reached. In such circumstances the meat is therefore condemned because of the possibility that food may be consumed in which living tubercle bacilli may still exist even after cooking.

It is not impossible to destroy by appropriate methods the organisms present in these cases of generalised infection ; either boiling or steaming conducted in a suitable manner may be relied upon to do it, and one or other of these methods is practised on the Continent to ensure sterilisation of the meat. Numerous appliances exist which undoubtedly effect the purpose desired. The actual centres of recognisable disease are, of course, first removed.

It does not follow that all tuberculous carcasses are totally condemned. The majority are not. When the disease, although it may be extensive in amount, has not become disseminated throughout the system by the arterial blood supply, the lesion is regarded as being localised. (This term is not used here in the strictest sense, and a complete explanation would require a long preliminary account.) In these localised conditions the affected part, which is known to contain the organisms, is removed together with a considerable margin of healthy tissue for safety, and the rest of the carcass passed for human consumption. The parts so condemned could be sterilised, but it is doubtful whether much meat worth sterilising could be saved from these localised condemnations. In the case of pig carcasses the

condemned part would generally be limited to the head, since extension would often be indicative of generalisation, and call for condemnation of the whole carcass. In cattle, the majority of instances would be fore-quarter meat or the parts condemned on account of disease of the peritoneum. In the former case, if any of the subdorsal glands were affected, probably the part of the joint nearest the vertebral column would be removed to ensure that no affected glands were left. The tissue underneath the pleuritic lesion would likewise be excluded, which would leave very little of value for sterilisation. Similar principles would require to be observed in the case of tuberculosis of the peritoneum. From these considerations it appears more likely that meat from totally condemned carcasses would form the greater bulk of that available for sterilisation.

Although tuberculous meat may be rendered non-infective, certain other associated circumstances require consideration before a decision to treat meat in this manner and submit it for sale is arrived at.

Sterilised meat would require to be absolutely under the control of the local authority both as regards selection of suitable portions, the necessary treatment and the subsequent sale. Further, regulations ought to be prepared by the Local Government Board to control the work under these headings if the Board grant approval to any such project. The details of selection would be somewhat on the lines indicated, viz., prohibition of the before-mentioned groups (*b*) and (*c*) and the approval of portions of (*a*) and the condemned portions in localised cases, each after the removal of recognisable lesions.

Butchers' meat is reasonably cheap in this country, and although the price has increased recently and possibly part of this increase will remain permanent, it remains to be seen whether there is sufficient of this meat available to justify arrangements being made for sterilisation, and also whether the difference in price between sound meat and unsound meat which had been sterilised would be wide enough to encourage the assumption that there would be a market.

Although about 1000 tons of meat are annually condemned at Smithfield as unfit for human consumption, the greater part of the beef is condemned on account of defective

condition. These defects are generally in the nature of putrefaction, and such meat would not be fit for human food even after sterilisation. This meat is trimmed and release is granted to parts which it can be satisfactorily stated are free from taint. Some tuberculous beef carcasses are discovered generally among home-killed produce, but the foreign inspections seem to succeed in eliminating all but a few of the tuberculous animals. Less than fifty tuberculous carcasses a year are discovered in imported beef. Pork and carcasses of the pig on the other hand are more generally affected with tuberculosis, and many carcasses of pigs of apparently otherwise good quality are condemned. Many of these could be sterilised after the affected parts had been removed.

At Islington, a lesser amount of beef is condemned and tuberculosis is the chief cause. I have no figures which would enable me to state the amount.

At the port, Dr. Willoughby informs me that "condition" again is the chief reason of condemnation, though tuberculosis is not infrequently observed in imported pigs. In general, the total condemnations are less than at Smithfield.

It is obvious, then, if the principle of sterilisation is approved, that a supply of suitable meat is available, but the totals recorded in annual reports of the officers concerned cannot be regarded as indicating the amount. Special observations would require to be made.

The sale of this meat would, as already stated, require to be conducted on special premises; and as giving some idea of the possible objections which might be raised, those advanced against the use of the Freibank may be stated.

It is often urged that the people of this country would not take kindly to the use of unsound meat even after it had been sterilised. They certainly would not if it were conducted on lines which permitted meat to be sold, affected with some of the conditions enumerated. If regulations were laid down which specifically stated what flesh could be used and these were strictly in accord with scientific knowledge as to its harmlessness, then the confidence of those who might be expected to use it could perhaps be gained and the objection die out. The standard to be aimed at has already been outlined.

It has also been stated that what is not fit for one person to eat is not fit for another. That would be a sound objection if conditions justified its being advanced, but no meat should be used which would not, after treatment, be fit for any one to eat, though all would not care to avail themselves of the opportunity.

It is argued that it might result in food being supplied under circumstances which prevented the consumer being aware that he was partaking of meat of inferior quality, *e.g.* if supplied to institutions, hotels, food preparation places, butchers and others. This would not happen if only small supplies were sold, and fraud would be guarded against by forbidding the preparation and sale of such sterilised food except under the direct control of the local authority.

Another point raised has been whether the food rendered available for human consumption by the method of sterilisation would be sufficient to justify the upsetting of a recognised standard. It is suggested that if municipalities proceeded to sterilise meat which is now condemned, a recognition that such meat if satisfactorily treated is fit for human consumption becomes firmly established, and therefore if a butcher sold tuberculous meat, which is to-day condemned, it would add to the difficulty of obtaining a conviction, since the argument might well be advanced " If the local authority can render it fit for human consumption, so can the purchaser if he goes the right way about it." This attitude could easily be met by official regulation.

Another caution I have heard put forward is that meat-poisoning outbreaks in Germany are more frequent than in this country, and perhaps the Freibank may contribute to this result. I have no facts either to prove or disprove this statement, but my general impression is that the frequency of food-poisoning outbreaks has some relation to the efficiency of the sterilisation of prepared foods. If flesh meat is consumed by the public in the raw or imperfectly cooked state, these outbreaks will be more frequent than among a community where flesh meat is rarely consumed until it has been cooked.

American advocates for the extension of the system see in it a means for helping in the eradication of tuberculosis, since farmers will not now use the tuberculin test owing to

the loss which is incurred if reacting animals, after slaughter, are found to be unfit for human consumption. In many instances the carcass would be fit for human consumption after sterilisation, and thus the loss would be reduced.

Again, assuming that the points above raised are answered in favour of the use of some tuberculous meat being sterilised and sold for human consumption, there is one aspect of the case which requires to be considered specially from the standpoint of the City Corporation.

There reside in the City only some 15,000 or so people. It is therefore more than probable that the purchasers of sterilised meat would be mainly among people who reside in districts outside the City boundaries, and this would necessitate the food being taken to districts beyond that in which the Corporation has jurisdiction. These authorities might raise objections unless the project were one promoted with the approval of the Local Government Board, and whether such approval with the necessary regulations would be forthcoming I am not in a position to state.

With a view to ascertaining the opinion of the expert advisers of these authorities, I submitted the case somewhat on the lines outlined above to a meeting of the Metropolitan Branch of the Incorporated Society of Medical Officers of Health in January, 1917, and after a full and free discussion the following resolution was carried :—

" That in the opinion of this Branch the destruction of meat condemned by officers of a local authority should be undertaken by the local authority, to whom there should be given also the power to convert condemned meat into food for animals, or manure, or materials to be employed for manufacturing processes, but that under no circumstances should it be converted into food intended for human consumption or be used in the preparation of food for human consumption."

The question of canning meat after sterilisation need only be considered from the same standpoint as that affecting other sterilised meat, except that it seems probable that the difference in the selling price between canned sound and canned unsound meat would be less than that between sterilised unsound meat and untreated sound meat.

The establishment of an intermediate grade of non-marketable meat, sold under special restrictions, untreated,

though declared to be unsound, cannot be considered. Such a proposal would not be acceptable either to the public or to scientific opinion in this country.

## Conclusion

In view of the above very definite pronouncement and of the uncertainty which exists as to whether the public would regard favourably the use of sterilised unsound meat, I am compelled to report that in my opinion it would be inadvisable for the Corporation to undertake the sterilisation of condemned meat with the object of subsequently selling to the public the meat so treated.

# INDEX

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